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United States Department of Agriculture

# REPORT OF THE FOREST SERVICE

Fiscal Year

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★ **Chief**  
12th & Independence Ave., SW  
P.O. Box 96090  
Washington, D.C. 20090-6090

#### **National Forest System**

- 1 Northern Region  
Federal Bldg.  
P.O. Box 7669  
Missoula, MT 59807
- 2 Rocky Mountain Region  
11177 West 8th Ave.  
P.O. Box 25127  
Lakewood, CO 80225
- 3 Southwestern Region  
Federal Bldg.  
517 Gold Ave., SW  
Albuquerque, NM 87102
- 4 Intermountain Region  
Federal Bldg.  
324 25th St.  
Ogden, UT 84401
- 5 Pacific Southwest Region  
630 Sansome St.  
San Francisco, CA 94111
- 6 Pacific Northwest Region  
319 SW Pine St.  
P.O. Box 3623  
Portland, OR 97208

- 8 Southern Region  
1720 Peachtree Rd., NW  
Atlanta, GA 30367
- 9 Eastern Region  
310 West Wisconsin Ave.  
Milwaukee, WI 53203
- 10 Alaska Region  
Federal Office Bldg.  
P.O. Box 21628  
Juneau, AK 99802-1628

#### **State and Private Forestry**

State and Private Forestry offices are located in the Regional Headquarters, except for the Eastern Region. This S&PF office is at:

- Northeastern Area--S&PF  
370 Reed Rd.  
Broomall, PA 19008

#### **Forestry Research**

- A Intermountain Forest and Range Experiment Station  
Federal Bldg.  
324 25th St.  
Ogden, UT 84401
- B North Central Forest Experiment Station  
1992 Folwell Ave.  
St. Paul, MN 55108

- C Northeastern Forest Experiment Station  
370 Reed Rd.  
Broomall, PA 19008

- D Pacific Northwest Forest and Range Experiment Station  
P.O. Box 3890  
Portland, OR 97208

- E Pacific Southwest Forest and Range Experiment Station  
1960 Addison St.  
Berkeley, CA 94704

- F Rocky Mountain Forest and Range Experiment Station  
240 West Prospect Ave.  
Fort Collins, CO 80526-2098

- G Southeastern Forest Experiment Station  
200 Weaver Blvd.  
P.O. Box 2680  
Asheville, NC 28802

- H Southern Forest Experiment Station  
T-10210 U.S. Postal Service Bldg.  
701 Loyola Ave.  
New Orleans, LA 70113

- ▲ Forest Products Laboratory  
One Gifford Pinchot Dr.  
Madison, WI 53705-2398



United States  
Department of  
Agriculture

**Forest  
Service**

**Washington, D.C.**

February 1989

# Report of the Forest Service

## Fiscal Year 1988

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Photo by Del Mar Jaquish

## The Forest Service

The Forest Service, U.S. Department of Agriculture, is responsible for Federal leadership in forestry. It carries out this role through four main activities:

- ▼ Protection and management of resources on 191 million acres of National Forest System lands.
- ▼ Research on all aspects of forestry, rangeland management, and forest resources utilization.

▼ Cooperation with State and local governments, forest industries, and private landowners to help protect and manage non-Federal forest and associated range and watershed lands.

▼ Participation with other agencies in human resource and community assistance programs to improve living conditions in rural areas.

F.S. Photo



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## 1988 Statistics

Receipts	\$1.62 Billion
Expenditures	\$2.69 Billion
Permanent Full-time Employees	28,800
Woodland Owners Assisted	167,432
National Forest System Lands Burned	1.2 Million Acres
Research Publications	2,227
Human Resource Programs	91,244 Persons Served
National Forest System	191 Million Acres
Wilderness	32.5 Million Acres
Road System	355,700 Miles
Trail System	106,834 Miles
Recreation Use	242.3 Million Visitor Days
Timber Sold	11.0 Billion Board Feet
Grazing Permits Administered	13,737
Wildlife and Fish Habitat Improvements	154,091 Acres
Livestock Grazing	9.9 Million Animal UnitMonths
Mineral Cases Processed	25,932
Insect and Disease Suppression	1.7 Million Acres
Reforestation	416.1 Thousand Acres
Timber Harvested	12.6 Billion Board Feet
National Wild and Scenic Rivers System	3,331 Miles
National Scenic Byways	560 Miles
Watershed Improvements	11,505 Acres



# Chief's Message

I have some good news to share with you about the Forest Service's accomplishments during fiscal year 1988.

With extra effort, we met all major output targets during a year with many of our people off fighting fires for most of the summer. We expanded our cooperation and involvement with the many diverse groups interested in the management of the National Forest System.

We added cooperative agreements with the Federation of Fly Fishers, Quail Unlimited, the Foundation for North American Wild Sheep, and Trout Unlimited to enhance wildlife and fisheries to our existing partnerships with Ducks Unlimited, the Wild Turkey Federation, the Ruffed Grouse Society, the Rocky Mountain Elk Foundation, and the American Fisheries Society.

We began implementing our Recreation Strategy, which is expanding the recreational opportunities on the national forests. In 1988, we targeted 30 projects under the recreation challenge cost-share program. About \$1.4 million was devoted to these projects and Forest Service partners have provided more than \$900,000 of this amount. The money is being used to rebuild recreation facilities, to build hiking trails, and to rehabilitate picnic sites.

Another important part of the Recreation Strategy is a National Forest Scenic Byways program. Scenic driving is the single most popular form of outdoor recreation on the national forests. Ten scenic byways were designated in 1988 showcasing 560 miles along highways in seven states. More scenic byways will be designated in coming years.

As I reported here last year, we have been looking for new ways to manage Forest Service business so that the American taxpayers get a better return



Photo by Jill Bauermeister

for their money. Our approach is working. I had the honor of accepting a Distinguished Service Award from the President on behalf of the Forest Service for its efforts in this area. The award recognizes the Forest Service for being a leader in changing the way the Agency operates with our Pilot Test experiment to increase efficiency and effectiveness. These changes are making a noticeable difference.

We stepped up the pace to strengthen the Forest Service through diversity in our workforce. Under our Workforce 1995 initiative, we are planning a workforce that is fairly representative of the civilian workforce at all levels. People with different perspectives and points of view will help the Forest Service better stay in tune with the people whom we serve. As one of our projects, we signed an agreement with North Carolina A&T University to encourage minorities and women to participate in the Forest Service volunteer program and to pursue education that will lead to careers in managing the Nation's natural resources.

In the midst of all this, we had one of the worst fire seasons ever in the United States. We had 72,750 fires burn over 5 million acres. Hard hit was the Greater Yellowstone Area where a combination of drought conditions, natural fuel buildup, and tree mortality due to insects produced one of the most intensive fire situations in recent times. During the wildfires, 41,000 fire personnel were mobilized, including crews from 39 states and Canada, with added help from military personnel and emergency firefighters who were trained and mobilized. Suppression efforts cost the Forest Service \$413 million.

During the second session of the 100th Congress, 45 Public Laws affecting Forest Service programs were enacted. This is a significant amount of legislation important to the Forest Service. Some major new laws of interest included Federal Land Exchange Facilitation, Removal of the Firefighter Pay Cap, Personal Liability Claims Against Federal Employees, Forest Ecosystem and Atmospheric Pollution Research, and Endangered Species Reauthorization.

In 1988 we also compiled the first test report of the Timber Sale Program Information Reporting System, which discloses all costs and benefits of the Forest Service's timber sale program. I'm happy to say that the report showed that receipts from this program exceeded costs by over \$500 million. By compiling and using this report, we will improve our accountability in the timber sale program and better explain its interrelationship with other resource activities and uses.

Research brought us closer to understanding the workings of our natural universe. We accelerated study of the effect of international trade on domestic forest resources and tariffs and non-tariff



barriers on forest products trade. We expanded our atmospheric deposition research program to include the effects of greenhouse gases and global climate change. Our acid rain research recently showed that trees become more vulnerable to insects and diseases and their growth is affected when calcium uptake from the soils is blocked through the effects of acid rain. We're also cooperating with Alabama A&M University to research the genetic improvement of southern pine and hardwood trees.

I think 1988 brought us closer to the public we serve and to the land we manage. Our work in 1989 will continue in the same vein.



F. Dale Robertson  
Chief



F.S. Photo



Photo by Ed Fox

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# Introduction



*Caring for the Land and Serving People*

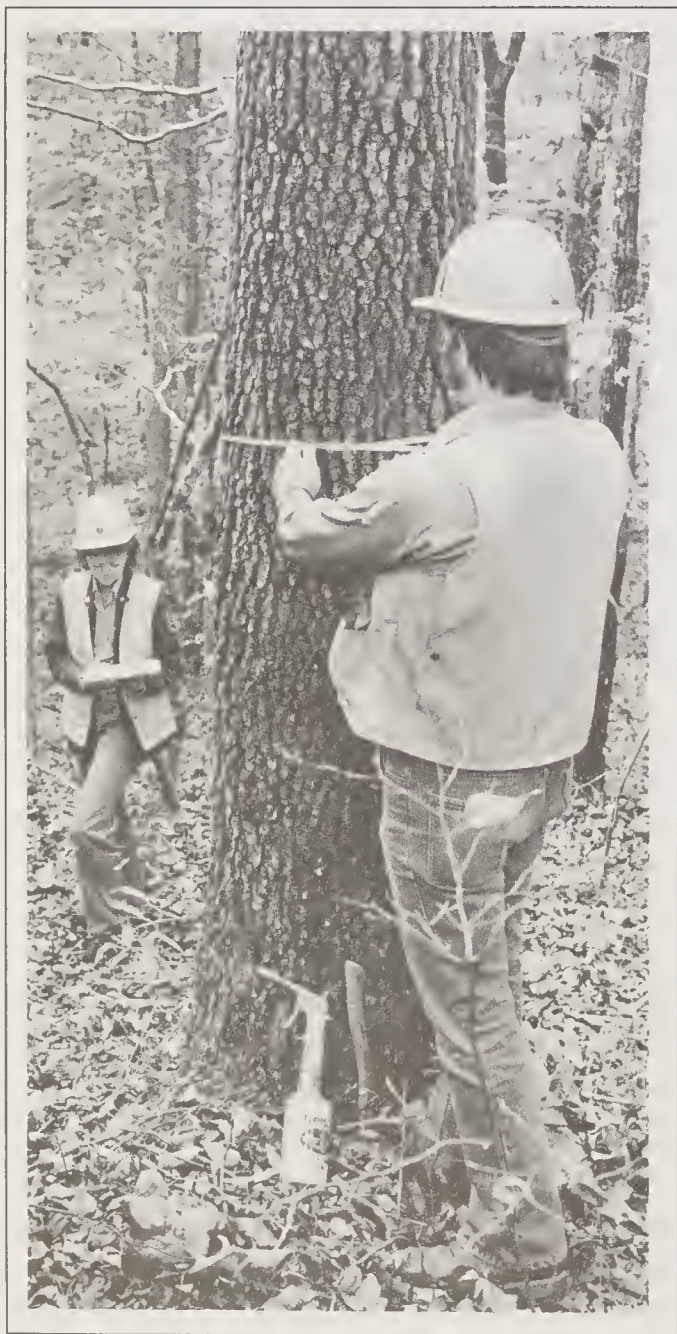
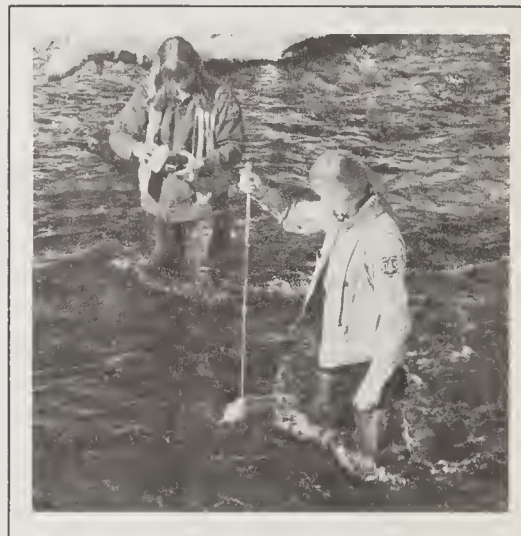


Photo by Barry Nehr

Photo by Del Mar Jaquish



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*From the Past to the Present*



## CARING FOR THE LAND AND SERVING PEOPLE

### Our Mission

We care for the Nation's forests and rangelands. We serve the needs of the people who own them. In short, we strengthen the Nation for future generations--and we are proud of our role.

The Forest Service is a leader in conserving and wisely using the Nation's forests and rangelands. We are stewards for 156 national forests, 83 experimental forests and ranges, 19 grasslands, and 15 land utilization projects. We work with State forestry organizations to help private landowners apply good forest practices on their lands. We perform research to find better ways to manage and use our national resources.

### A Proud Heritage

**Our Conservation Philosophy.** On February 1, 1905, President Theodore Roosevelt signed the Transfer Act which shifted the responsibility of caring for the Nation's forest reserves from the Department of the Interior to the Department of Agriculture. That same day, Secretary of Agriculture James Wilson endorsed Gifford Pinchot's conservation philosophy of wise use and service to the American people. The forest reserves, later renamed the national forests, were to be managed for the greatest good for the greatest number of people in the long run. Local questions were to be decided by local officials--a philosophy that has placed the Forest Service among the more decentralized agencies in the Federal Government, with a corresponding commitment to work closely with local people while responding to national interests and needs.

**Values and Principles.** Early forestry leaders like Roosevelt and Pinchot combined vision with action. Their principles and philosophies helped mold Forest Service values and culture that have stood the test of time--conservation leadership, public service, responsiveness, integrity, a strong land ethic, and profes-

sionalism characterized by people who know their jobs and do them well.

These values and principles are the bedrock on which the Forest Service stands--they will support us as we adapt to change and thrive on challenge.

## LEGISLATIVE BASIS FOR THIS REPORT

The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, as amended, directs the Secretary of Agriculture to prepare a comprehensive, long-range assessment of the Nation's renewable resources and to develop a program for Forest Service activities.

The RPA requires the Secretary to submit to Congress an annual report on Forest Service accomplishments and progress in carrying out the RPA Program. This report covers fiscal year 1988. 1/

Required in the annual report are the following:

▼ A description of the status of major research programs, significant findings, and ways these findings will be applied in programs.

▼ A description of the cooperative forestry assistance programs and their accomplishments, status, needs, and work backlogs.

▼ A report on the progress of incorporating mandated standards and guidelines into the land management plans for the units of the National Forest System.

▼ A summary, on a representative sample basis, of estimated expenditures for reforestation, timber stand improvement, and the sale of timber from the National Forest System--compared to the return to the Government from such timber sales.

▼ An identification, on a representative sample basis, of advertised timber sales made below the estimated expenditures

mentioned above.

This document includes the following reports that Congress requires at the time of the annual report:

▼ A report identifying the amount and location, by Forest, State, and productivity class, of (1) all lands in the National Forest System where land management plans have indicated the need to reforest areas that have been cut over or otherwise denuded or deforested, and (2) all lands with stands of trees that are not growing at their best potential.

▼ An estimate of the funds needed to successfully replant an acreage equal to the acreage to be cut over that year.

▼ A report on the amounts, types, and uses of pesticides used in the National Forest System, including the beneficial or adverse effects of such uses.

In addition to the requirements of the RPA, this annual report contains information on accomplishments and outputs in relation to commitments in the appropriate Forest Service budget.

1/ Unless otherwise stated, all references to years in the report are fiscal years.



Photo by K. L. Grove



# *National Forest System*



Photo by Del Mar Jaquish



## INTRODUCTION

The Forest Service manages and protects the National Forest System, which consists of 191 million acres of land. That is an area nearly as large as the 14 Eastern States from North Carolina north through New England.

The natural resources on these lands are among the Nation's greatest assets; they affect the economic, environmental, and social well-being of all Americans. Managed for many uses and benefits at a cost of about \$2.25 billion, the national forests and national grasslands returned \$1.62 billion in receipts and users fees to the Treasury in fiscal year 1988.

The National Forest System lands:

- ▼ Provide habitat for nearly 60 percent of the animal species in the Nation, including 166 threatened or endangered species, or about 30 percent of the Nation's total.
- ▼ Supply more outdoor recreation than lands under the jurisdiction of any other Federal agency--more than 40 percent of the total--nearly a quarter billion visitor days a year.
- ▼ Include more than 32 million acres of the National Wilderness Preservation System--79 percent of the total, outside of Alaska, or 1 acre of every 6 of the National Forest System is in designated wilderness.
- ▼ Are the source of about 50 percent of the West's water supply and about 5 percent of the East's.
- ▼ Contain 128,000 miles of streams and 2.2 million acres of lakes, ponds, and reservoirs, primarily in the 11 Western States--important recreation and fisheries resources.
- ▼ Are a storehouse of nearly 50 percent of the Nation's softwood sawtimber and provide about 13 percent of the wood harvested annually in the United States.

- ▼ Contain almost 25 percent of our potential energy reserves and hold unique deposits of some critical minerals, including approximately 14 percent of the world's known lead and 25 percent of its molybdenum.
- ▼ Provide nearly 104 million acres of forage-producing areas in 35 states for wildlife, domestic livestock, and wild, free-roaming horses and burros.
- ▼ Return 25 percent of receipts to 41 State governments and Puerto Rico for funding public schools and roads in counties where the national forests are located, a total of \$293.3 million in 1988.

Managing the National Forest System can be controversial. Today, debate about how these priceless assets should be managed is not much different than in Gifford Pinchot's time, 8 decades ago. We still are trying to decide what is the appropriate share of the resources to be dedicated to meet the varied and sometimes conflicting needs and desires of our shareholders.

The Agency's Forest Land and Resource Management Plans for the national forests address the balance and appropriate share question. Through the Plans, and with unprecedented public support, Forest Service leadership and initiative are bringing more balance and harmony to national forest management by placing increased attention on recreation, fish, and wildlife programs and activities.

Public involvement is not limited to land and resource management planning. A multitude of substantial and financially valuable national forest partnerships with private groups and individuals are in place and working to enhance our capability to manage lands and resources.

## LAND MANAGEMENT PLANNING

### The Planning Process

The land management planning process assists the Forest Service in determining the best use of all resources on the 191 million acres of the National Forest System, including recreation, fish and wildlife habitat, water, timber, minerals, range, and wilderness. This integrated planning process stems from the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, as amended by the National Forest Management Act (NFMA) of 1976.

The process also helps managers respond to current demands in a way that ensures that adequate supplies will always be available. Land management planning is a continuing process; it addresses changes in the demands made on the supply of renewable resources. The Forest Service, in cooperation with the public, will update and amend forest plans as needed to ensure that adequate resources will be available for future generations.

### Regional Guides

All nine Regional Offices have published the Final Regional Guides and Environmental Impact Statements (EIS's) that were required by NFMA. Included in each guide are major issues and management concerns of the region, as well as tentative resource objectives recommended by RPA for each national forest within the region. Although the guide ensures that a consistent approach to national forest planning is followed throughout the region, it allows managers on the individual forests considerable latitude in formulating forest plans. The guide also helps coordinate National Forest System programs with State and Private Forestry and Research programs.

### Status of Forest Plans

A total of 123 forest plans are being developed under NFMA. The Washington Office has reviewed drafts



of all these plans, except for the Klamath National Forest. The Tongass National Forest plan, completed in 1979, will be revised during 1989. During 1988, 5 forest plans were finalized, bringing the total to 90. There currently are 32 plans in draft form. Seven draft supplements were filed on forest plans during 1988.

Table 5 lists the draft and final forest plans and Environmental Impact Statements (EIS's) prepared to date.

### Funding Implementation of Forest Plans

We have strengthened our ability to reorganize the budget needs in implementing forest plans. Forest plan objectives are projected on a 10-15 year basis, and reflect local and regional perspectives, including local supply capabilities and market conditions. However, the budget process adjusts the planned outputs on an annual basis from the desired level to one reflecting current economic conditions and realistic expectations. The ability to achieve outputs projected by a forest plan will be reflected by the rate at which the plan is

implemented, based on budgets approved by the Congress. If at any time the objectives of the plan become unachievable, it will be necessary to amend the forest plan.

### Status of NFMA Appeals

The appeals process allows higher Forest Service organizational levels to review a decision. It also enables persons to object to decisions in the forest plans and to guarantee that the objections are reviewed fairly and objectively. Approximately 747 appeals have been filed on forest plans, of which 409 have been resolved. At the close of 1988, 39 forest plans had been cleared of all appeals.

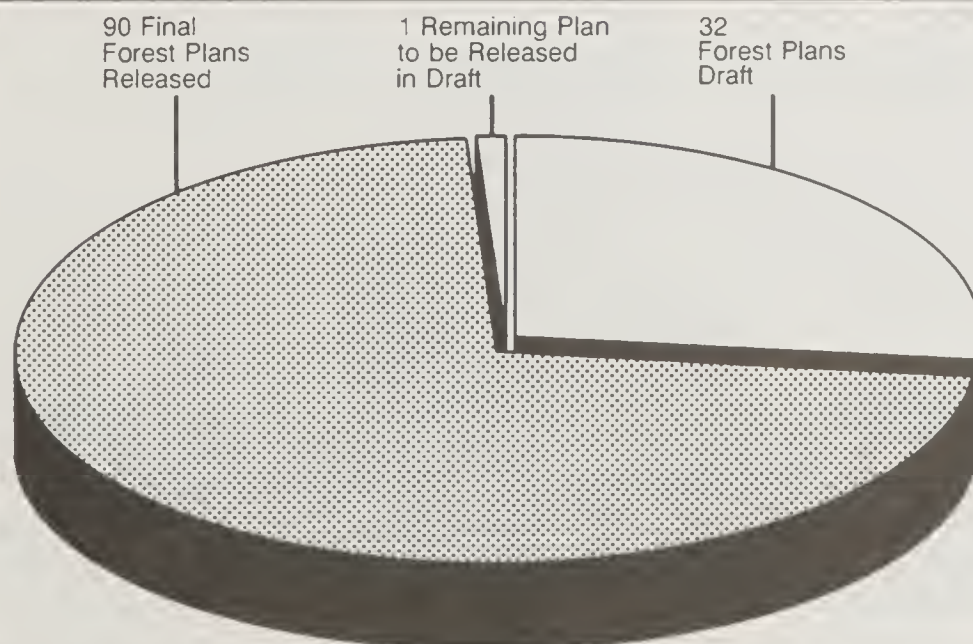
The Pacific Northwest Regional Guide is the only guide that has been appealed. The Secretary's office remanded the guide for additional analysis and for preparation of a supplement to the guide that would address how much habitat must be protected to ensure the viability of the northern spotted owl. The draft supplement was published in August 1986 and made available for public review and comment. Approximately

40,000 written comments were received and the final supplement was released in August 1988. A record of decision was signed on December 8, 1988.

### Wilderness Legislation

At the beginning of calendar year 1988, there were approximately 32.5 million acres of wilderness in the National Forest System. Legislation was introduced to create additional wilderness in the States of Nevada, West Virginia, Virginia, and Montana, and as the year progressed, legislation also was introduced for the States of Idaho, Oklahoma, and Alabama. In mid-year, Congress passed the Virginia Wilderness Act, resulting in 27,687 acres (including 2,500 acres in West Virginia) being added to the National Wilderness Preservation System. As the 100th session drew to a close, Congress passed and enacted two additional wilderness bills--Alabama (13,945 acres) and Oklahoma (13,954 acres). In addition to the wilderness designation, several areas with unique management requirements also were designated as part of the Oklahoma Act. Although the Montana legislation passed Congress on the last day of the session, it was vetoed by the President on November 2, 1988.

### Status of Forest Plans



### Wild and Scenic Rivers

Legislative action during 1988 resulted in the designation of 35 additional national forest rivers as part of the National Wild and Scenic Rivers System, of which 32 were included in the Omnibus Oregon Wild and Scenic Rivers Act of 1988, adding 850 miles of national forest rivers to the system. The Sipsey Fork (61.4 miles) in Alabama, the Rio Chama (3.1 miles) in New Mexico, and the Wildcat River (14.5 miles) in New Hampshire also were designated. The National Wild and Scenic Rivers system now totals about 9,250 miles, of which 3,331 are under Forest Service management.

Congress authorized studies on 7 additional rivers in Oregon--the



*Recreationists enjoy the solitude offered by the Black Creek Wild and Scenic River on the DeSoto National Forest. The national rivers system now includes 3,331 miles administered by the Forest Service.* Photo by Barry Nehr

Blue, Chewaucan, North Fork Malheur, South Fork McKenzie, Streamboat Creek, Upper Klamath, and Wallowa. Other congressional authorized studies are continuing on the Allegheny in Pennsylvania and the White Salmon and Klickitat in Washington.

Studies conducted as a part of the national forest planning process have identified more than 400 additional rivers with outstanding values that make them eligible for the National Wild and Scenic Rivers System. Tentative results recommend designation for 45 of these rivers and recommend 246 rivers for further study by the Forest Service. Some national forests have made suitability determinations for wild and scenic rivers in the forest plans, while others have deferred further study until a later date.

Agency initiated studies also are continuing on the Henry's Fork in Idaho, the Little Bighorn in Wyoming, the Nolichucky in North Carolina, and the Sopchoppy in Florida. The Ozark-St. Francis and Ouachita National Forests in Arkansas are continuing forest-wide

studies of 15 rivers that have been identified as eligible for wild and scenic river status in the forest plans.



*Pronghorn antelope graze alongside the Black Thunder Mine on the Thunder Basin National Grasslands in Wyoming.* Photo by Jack Cameron

## MINERALS

Energy-producing resources found beneath National Forest System lands include oil, natural gas, coal, geothermal steam, and uranium. Minerals of strategic importance under these lands include platinum, palladium, chromium, nickel, tungsten, and molybdenum. Gold, copper, zinc, silver, and phosphate also are found in significant amounts.

The Forest Service ensures that mineral resources are developed in a manner compatible with the management of other resources. The Agency cooperates with the Department of the Interior for coordinating the management of federally owned minerals within the National Forest System. The Forest Service also works with State and local agencies in managing and developing private minerals estates.

In 1988, total receipts from rents, royalties, sales, and bonus bids for minerals totaled an estimated \$181 million, over \$31 million more than in 1987. Increased revenues for 1988 resulted



primarily from privately owned minerals that reverted to Federal ownership. A small part of the fiscal year 1988 receipts are the direct result of activities conducted this year. An estimated 90 percent of the 1988 receipts result from work done in prior years. Similarly, 1988 accomplishments will lead to receipts in future years.

During 1988, we processed 25,932 leasable, locatable, and salable mineral cases. This number falls between the RPA Low and High bound levels, and exceeds the funded target by 16 percent (table 1). The funded minerals case load target represents an estimate of the anticipated workload and tends to fluctuate as minerals market conditions change. Activities accomplished included processing, approving, and administering new lease applications, prospecting permits, validity examinations, operating plans, geophysical permits, and mining proposals for private minerals estates. Contributions from industry, aimed at funding environ-

mental analyses associated with mineral activities, were estimated at \$1.3 million. Activities related to gold and platinum-group metals continued to increase in 1988.

Although accomplishments exceeded the RPA and funded targets, the number of cases remaining unprocessed at the end of the year increased from 1,571 in 1987 to an estimated 1,718 in 1988 (table 7). Of the unprocessed cases, 770 were located in areas, such as wilderness study areas, where land use questions remain.

The mineral withdrawal review, which involves 1,980,000 acres of National Forest System lands and is required by the Federal Land Policy and Management Act of 1976, Section 204(k)(1) (43 U.S.C. 1714), is about 80 percent complete. There are 1,681 separate withdrawals that affect 6,150 individual sites. In 1989, the Forest Service review will be completed and will be incorporated into the Secretary of

the Interior's report to the President, which is scheduled for 1991.

Since the passage of the Federal Onshore Oil and Gas Leasing Reform Act of 1987, the Forest Service has formulated regulations for administering and managing the minerals resource. These were developed in coordination with special interest groups, industry and the Bureau of Land Management. In addition, the National Academy of Sciences and the General Accounting Office continue to conduct studies to evaluate the manner in which oil and gas resources are considered in forest plans.

## LANDS

### Landline Location

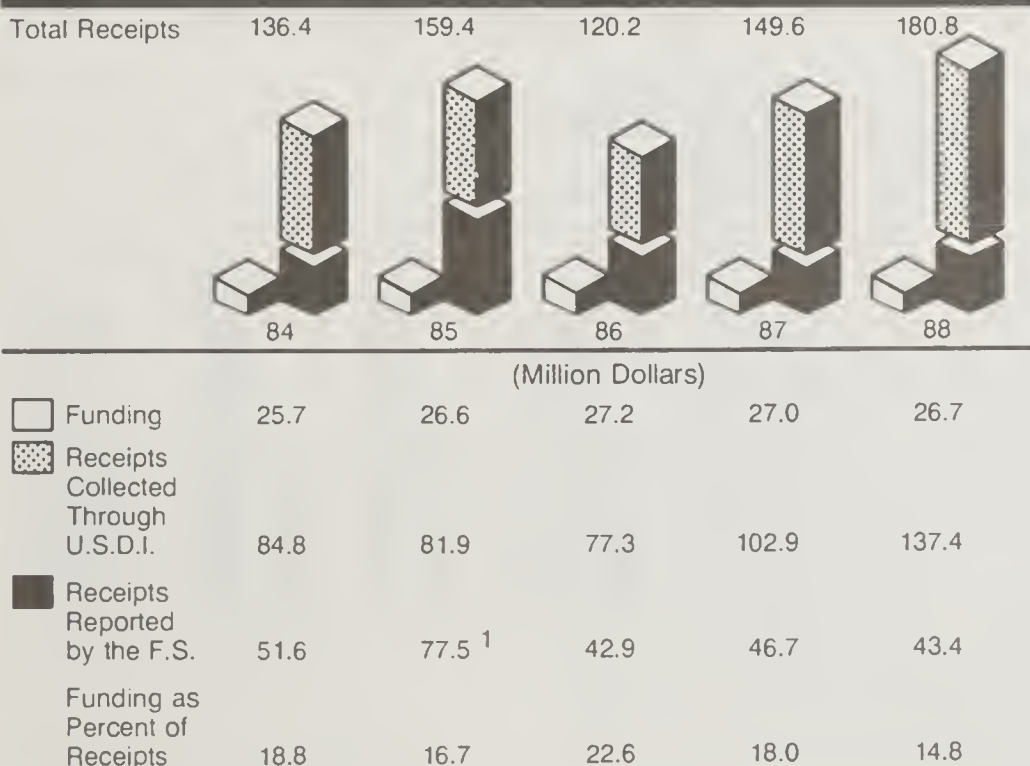
In 1988, the Forest Service used the \$26.7 million appropriation to locate a total of 4,581 miles of property boundary, 12 percent more than the funded target of 4,104 miles. The Agency was able to exceed the target primarily because of efficiencies gained through advances in technology and procedures.

Accurate location of landlines--the legal boundaries between National Forest System lands and other ownerships--is essential for managing and protecting these lands from encroachment. The RPA recommendation is to locate, mark, and post all National Forest System property boundaries by the year 2020. By the end of 1988, we completed 90,002 miles of the total 272,409 miles of National Forest System property boundaries.

### Land Exchange

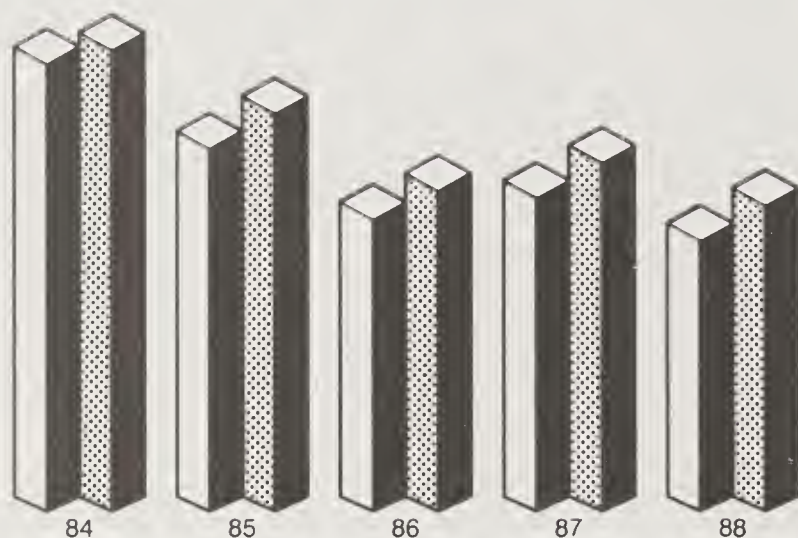
In 1988, the Forest Service exchanged 90,944 acres of National Forest System land for 125,854 acres of non-Federal land. As a result of continuing emphasis on exchange as the preferred alternative to purchase, more than 100 percent of the planned land exchanges were completed.

### Minerals-Funding and Receipts





<sup>1</sup>See table 57, footnote 1.

### Landline Location Accomplishments



(Thousand Miles)

	Funded	6.6	5.4	4.4	4.7	4.1
	Accomplished	6.8	5.9	4.8	5.2	4.6

### Small Tracts Act Cases

The Small Tracts Act of 1983 authorizes the Secretary of Agriculture to sell or exchange certain small parcels of National Forest System land. Included are unmanageable parcels of various sizes and shapes located between mineral patents, small parcels innocently occupied (for example, where a private home has been inadvertently built over a National Forest System property line), and road rights-of-way no longer needed. Since February 1984, when regulations to implement the Small Tracts Act became effective, 820 cases, mostly involving encroachment, have been resolved (165 cases in 1988). In all, 1,235 acres of Federal land have been conveyed, and as consideration the United States has received 979 acres of land and been paid \$1,133,400.

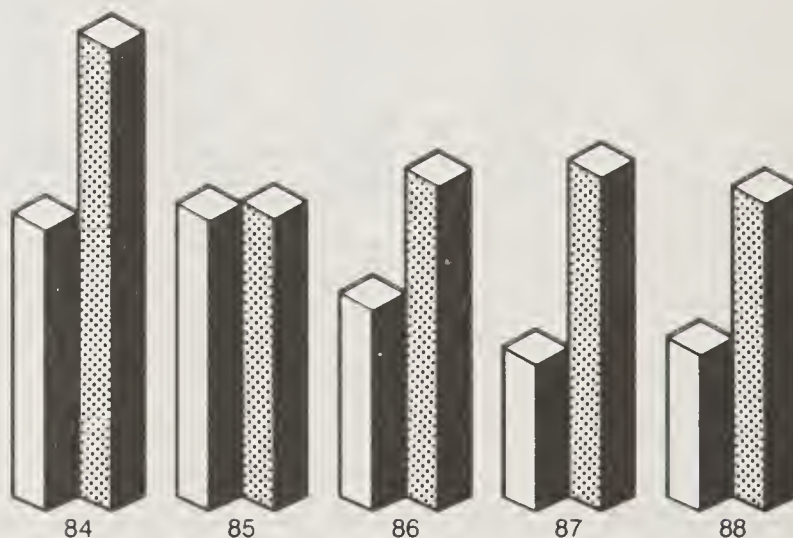
### Land Purchases and Donations



The Forest Service purchased 58,186 acres of land and interests in land with

These exchanges consolidated National Forest System lands, making it more efficient to manage and administer various resource programs. For example, these land exchanges served to reduce national forest property lines by 1,374 miles in 1988. This is expected to save about \$7.6 million in future landline location costs, or about 1.5 times the \$5.2 million cost of exchange efforts. Additional savings will result from fewer trespass cases, special-use permits, and rights-of-way cases in future years.

Much of the non-Federal land acquired through land exchanges is within classified wilderness areas, national recreation areas, wild and scenic rivers, national trails, and other congressionally designated areas. In each case, it was more cost-effective to exchange lands than to purchase them. In 1988, non-Federal landowners paid \$865,425 in cash equalization payments, while the United States paid \$217,720. The total amount (\$1.08 million) was less than 2 percent of the appraised land value.

### Land Exchange Accomplishments



	Thousand Acres Funded	116	117	85	65	68
	Thousand Acres Accomplished	186	119	133	135	126



money provided from the Land and Water Conservation Fund, Receipts Acts and other appropriations. In addition, landowners donated 257 acres of land and interests in land to the National Forest System.

### Land Transfers

During 1988, the Forest Service accepted title from the U.S. Marshals Service to three parcels, totaling 88 acres, in Arkansas and Tennessee. They were properties seized under the Comprehensive Crime Control Act of 1984. The cost to the Forest Service was \$5,150. The value of the properties was estimated at \$50,000.

### Road Rights-of-Way

As a result of 616 separate transactions in 1988, the Forest Service acquired more than 400 miles of road rights-of-way, including 293 miles of existing roads, at a cost of \$330,000. Ownership of these rights will improve or protect access to the National Forest System for all users.

## TIMBER

### Program Overview

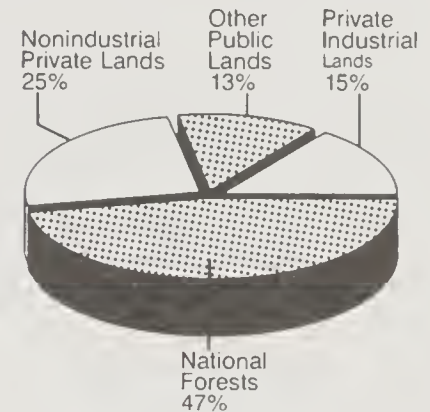
One of the Forest Service's mandates is to help ensure a continuing and, where appropriate, increasing supply of timber products to meet the needs of America's people. While the harvesting of timber products--logs for lumber and plywood, wood fiber for paper, fuelwood, posts, poles, and Christmas trees--is correctly thought of as the output of the timber management program, the total objectives of the timber program encompass a wider range of benefits. Some of these benefits include protecting and enhancing wildlife habitat, providing recreation opportunities, increasing wildlife and domestic forage, implementing watershed improvement projects, growing sufficient nursery stock, and improving tree genetics.

Achieving desirable objectives in wildlife, recreation, range, watershed, and other resource areas often necessitates the prudent management of vegetation. Where that vegetation happens to be trees, the timber program may be the most cost-effective and appropriate way to achieve those resource objectives.

### Inventory and Planning

The Forest Service annually inventories approximately 10 percent, or about 16.5 million acres, of its forested land base for timber information. This information, together with information about other renewable resources, is used in the developing forest plans under the National Forest Management Act planning process and in the RPA Assessment. Under this process, each of the 123 national forest administrative units establishes new allowable sale quantities (volume of timber that may be sold for harvest) and outlines timber management activities for the next 10 to 15 years.

### Inventory of Standing Softwood Sawtimber Percent by Ownership



In 1986, national forests had the largest inventory of standing softwood sawtimber in the Nation, estimated at nearly 1 trillion board feet. This was about 47 percent of the national total. Nonindustrial private forest lands



*A forester measures the height of trees with a clinometer to determine growth and volume for timber inventory.* Photo by Barry Nehr

accounted for 25 percent of the total; private industry had 15 percent; and other public lands had 13 percent.

### Old-Growth Timber

Old-growth timber harvest has generated extensive discussion among the Forest Service, Congress, and interest groups. The Forest Service is continuing efforts to update its inventories with more sophisticated sampling techniques to monitor growing conditions and to establish baseline data. The controversy concerning the definition of old-growth timber continues to create confusion about the amount of remaining old-growth and its condition. The Forest Service and Oregon State University sponsored a symposium in August 1988, to solicit public input about old-growth management. The major focus of the old-growth issue is on the national forests on the west side of Oregon and Washington and in northern California. Both the Pacific Southwest and Pacific Northwest Regions are developing and implementing forest inventory systems that respond to the need for better statistical and spatial information on old-growth.

### Silvicultural Examinations

Silvicultural examination is the process of obtaining the site and stand characteristics needed to identify existing stand conditions, capabilities, and trends. In 1988, this program examined 5.7 million acres. Data from silvicultural examinations are used in developing site-specific silvicultural prescriptions to meet multiple-use objectives on national forests. Silvicultural examinations also provide essential basic tree data for use in implementing the Forest Land and Resource Management Plans.

### Timber Sale Preparation, Offering, and Harvest

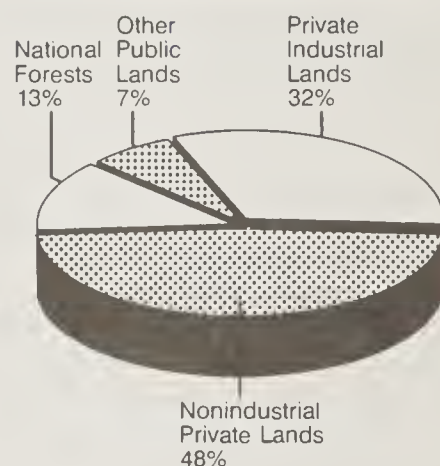
National forests provide about 13 percent of the total wood volume harvested annually in the United States. This compares to about 48 percent from nonindustrial private forest lands, 32

percent from lands owned by industry, and 7 percent from other public lands. In 1988, national forest timber harvest provided about 28 percent of the total softwood lumber consumed.

During 1988, the Agency's accomplishments in relation to 1988 funded targets were 98 percent for timber offered for sale. Compared with the recommended levels established in the 1985 RPA program, the 1988 accomplishment was 113 percent for timber offered in the Low Bound level, and 98 percent in the High Bound level.

The Forest Service's timber management program continues to bring in more money than it spends. In 1988, the cost of the timber management program was \$444.4 million (table 18). The value of timber harvested in 1988 was

**Percentage of Total Annual Wood Harvested from Lands in the United States**



*A timber contractor stacks Douglas fir logs on a timber sale on the Gifford Pinchot National Forest. Nationwide, Forest Service timber sales provided 13 percent of the total wood volume harvested. Photo by Jim Hughes*



\$1,235.7 million (table 12). The total number of contracts and permits sold in 1988 was 501,341, including nonconvertible product permits.

The timber sale program goal for 1988, as directed by Congress, was to prepare and offer for sale 11.476 billion board feet. The Forest Service actually offered 11.348 billion board feet, and it sold 10.968 billion board feet. The primary reason for the offer amount not meeting funded targets was because of appeals and litigation of proposed timber sales. Also included in the offer volume is the preparation and release for harvest of 0.3 billion board feet of long-term timber sales previously reported as sold. The value of timber sold was \$1,254.4 million. This compares to 1987 sales of 11.319 billion board feet valued at \$1,003.4 million. The average bid for timber in 1988 was \$114 per thousand board feet, compared to \$89 in 1987, \$69 in 1986, and \$52 in 1985. The

increase in average bid reflects, in part, the continuing upturn in timber demand.

The harvest volume for 1988 reached 12.6 billion board feet, compared to 12.7 billion board feet in 1987, which was an all-time record-high level, having eclipsed the previous record harvest of 12.4 billion board feet set in 1973. The value of timber harvested in 1988 was \$1,236 million, compared to \$1,016 million in 1987.

Because of upward market trends, the volume of uncut timber under contract decreased to 21.8 billion board feet in 1988, compared to 24.9 billion board feet the previous year. The volume under contract includes sales that were extended, but does not include volume from unresolved defaulted sales. It also includes some sales whose status remains unresolved during Title 7 bankruptcy proceedings. Long-term sales volume is not included in the total,

as this volume is only available as it is released for cutting. The current volume under contract for the long-term contracts is 6.594 billion board feet.

Under the Federal Timber Contract Payment Modification Act of 1984, timber purchasers returned 1,578 sales containing 9,748 million board feet. In 1988, a total of 1,622 million board feet was reoffered for sale. Since 1986, 6,172 million board feet have been reoffered.

### Salvage Sale Program

The salvage sale program was authorized under the NFMA. It allows the Forest Service to use money from salvage sales to cover the cost of preparing and administering the sale of insect-infested, dead, damaged, or downed timber, along with the engineering work necessary for the roads needed for these sales.

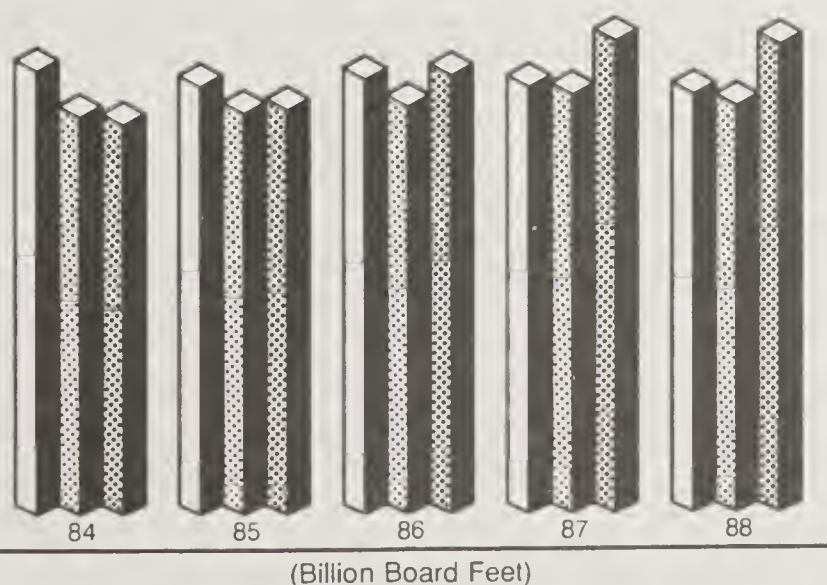
In 1988, the Forest Service sold approximately 2.2 billion board feet of salvageable timber through the salvage sale program. This represents about 92 percent of the total National Forest System mortality volume sold. Small timber operators with less than 25 employees purchased about 7 percent of the timber sold under the salvage sale program.

Major salvage sale offerings occurred as a result of fire and blowdown in the Pacific Northwest and California and from the mountain pine beetle outbreaks in the northern Rocky Mountain area.

### Fuelwood

The amount of fuelwood removed from National Forest System lands continued the decline that began in 1982, when a high of 5.2 million cords of fuelwood were provided. In 1988, the equivalent of 1.4 million cords of fuelwood were sold or provided free, compared to 1.6 million cords in 1987. The decline reflects both the decreasing demand resulting from lower prices for gas and oil and the continuance of a charge per-

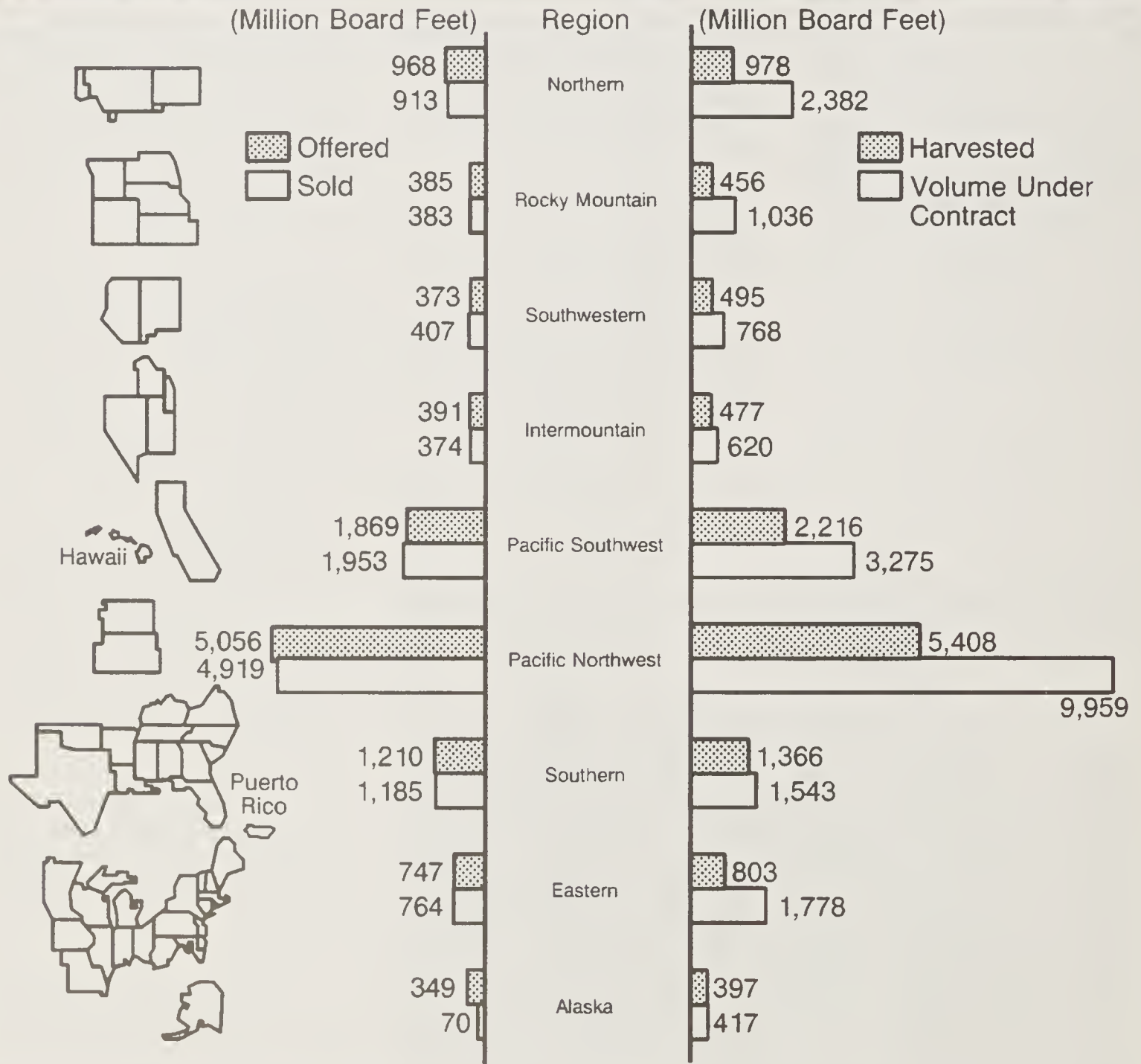
### Timber Offered, Sold and Harvested



	84	85	86	87	88
Offered	11.9	11.5	11.7	11.5	11.3
Sold	10.7	10.8	11.0	11.3	11.0
Harvested	10.5	10.9	11.8	12.7	12.6



## Timber Offered and Sold

Timber Harvested and Uncut  
Timber Volume Under Contract

### SUMMARY OF TIMBER SALE BUY-OUT RETURNED AND REOFFERED VOLUME

Region	No. of Sales	Total Volume Returned (MMBF)	Total Buy-Out Charges Billed (\$1,000)	Volume Reoffered in 1986 (MMBF)	Volume Reoffered in 1987 (MMBF)	Volume Reoffered in 1988 (MMBF)	Total Volume Reoffered to Date (MMBF)
1	112	665	9,108	132	144	76	352
2	13	33	328	5	5	4	14
3	26	166	1,758	16	49	52	117
4	17	40	464	2	30	1	33
5	226	1,997	43,009	293	337	191	821
6	991	6,627	112,718	1,798	1,579	1,297	4,674
8	136	202	2,607	69	80	0	149
9	57	18	185	4	9	1	14
10	0	0	0	0	0	0	0
	1,578	9,748	170,177	2,319	2,231 1/	1,622	6,172 1/

1/ Columns do not sum due to rounding. Totals shown are National totals.

### Forest Fire Damage and Recovery

The summer of 1988 was a repeat of devastating forest fires that occurred in California, Oregon, and Washington in 1987. More than 103 fires burned over 2 million acres of national forests and national parks (excluding Alaska). Montana, Wyoming, Utah, and California were the hardest hit.

Public concern to rehabilitate burned areas has resulted in pledges and contributions of money.

Over 41 emergency fire assessments have been completed in 1988, with over \$6 million approved for emergency recovery efforts. Much of the initial emergency work--seeding and erosion control structures--to protect soil and water values is underway. However, the 1988 fires have added substantially to the backlog of work that needs to be done. Approximately 160 million board feet of fire damaged timber can be salvaged and 50,000 acres are in need of reforestation. Followup work and maintenance will be necessary to prevent damage and flooding from the fall and winter storms.

During 1988, the Forest Service moved aggressively to salvage timber to reduce losses and to implement reforestation plans to maintain the productivity of the national forests. The timber program accomplishments for the 1987 fires included reforestation of 4,000 acres and the sale of 1.4 billion board feet of fire damaged timber. Seven hundred million board feet of the fire damaged timber were harvested. Seed was sown in nurseries to reforest at least 22,000 acres in 1989.

Remaining work to be accomplished as a result of the 1987 fires includes 400 million board feet of fire damaged timber to be salvaged, 221 thousand acres of reforestation, and continuation of the fire research work that was begun in 1988.

In addition to appropriated funds, receipts from the salvage of timber are being deposited in special accounts and

### HOW VALUES ARE CALCULATED

**Value of Timber Products Sold.** The value of timber products sold is an estimate of the amount the Forest Service expects to receive from the timber sale, based on the bid rates. It does not include purchaser credit--the value of permanent roads built by purchasers. It includes all types of sales, products, and tree species.

**Value of Timber Products Harvested.** The value of timber products harvested is the adjusted amount paid by the purchaser at the time of harvest. The value does not include purchaser credit. The value of timber harvested from a sale may differ from the bid value because of price adjustment provisions in the contract and differences between estimated and actual volumes.

**Money Received From Timber Products.** Money that the Forest Service receives from the sale of timber products varies from reported harvest value because of the time delay between billing and receipt of payment.

mit instead of the free-use program on most forests. It is believed that the decrease in fuelwood consumption also may be related to higher employment

levels, higher costs of equipment, more restrictions on the use of wood-burning equipment, and less time available to obtain fuelwood.

expended for erosion control, wildlife and fish habitat restoration, reforestation, road maintenance and repair, and other resource needs to recover from the effects of the fires. These receipts are only available for use on salvage sale areas.

## Reforestation

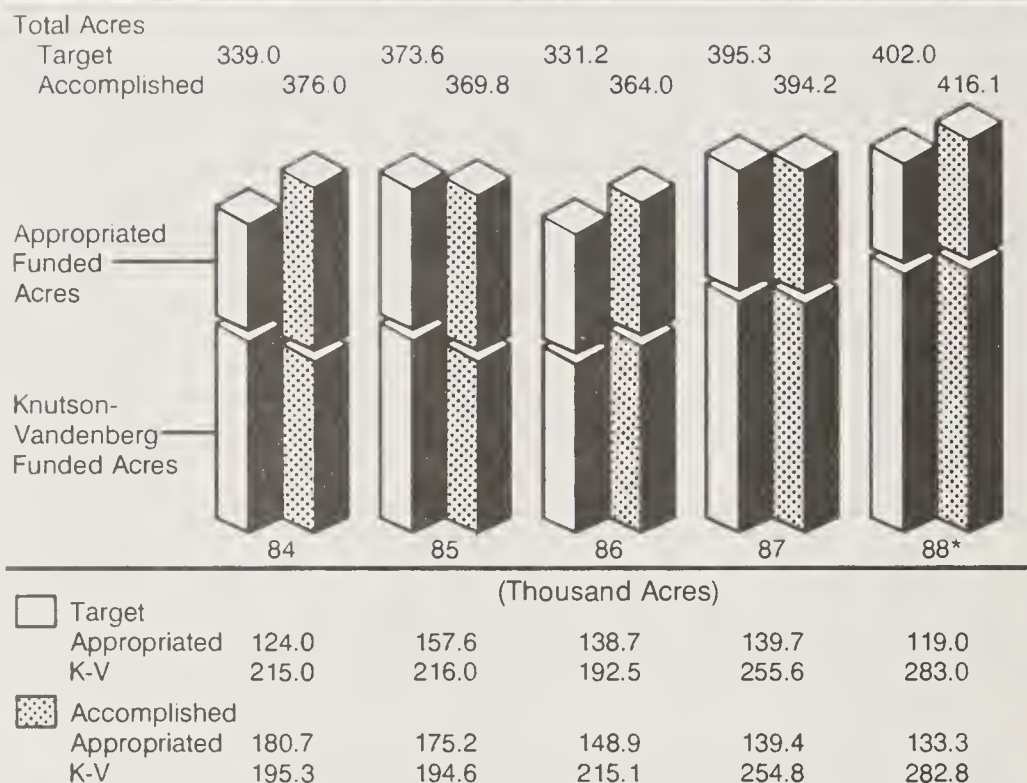
Reforestation of suitable forest land occurs through natural processes or the planting of seeds or nursery-grown seedlings. In 1988, about 36,800 acres of National Forest System land were certified as reforested naturally, and 133,300 acres were reforested using appropriated and Reforestation Trust funds. An additional 282,800 acres were reforested using money set aside from timber sales under the Knutson-Vandenberg Act (tables 19-21). This was a record amount of reforestation accomplished through K-V funding. The total number of seedlings planted on the national forests by all funds was 164.8 million.

Even though the Forest Service reforested more land in 1988 than in 1987, the increase in reforestation was offset by the increase in acreage needing to be reforested. At the close of 1988, about 1.2 million acres needed reforesting, up 77,000 acres from 1987. This increase occurred primarily because of high timber harvesting levels nationally, the extreme wildfire damage in western regions, and a continuing severe bark beetle outbreak in northeastern Utah.

Over the last 5 years, an average of 89 percent of all reforestation treatments has successfully met stocking objectives. In 1987 (the latest year for which data are available), the reforestation success rate was 93 percent. This was about 2 percent above 1986, which had a reduced rate because of the severe drought in the Southern States, portions of the Intermountain Region, and California.

The average cost of all reforestation in 1988 was about \$326 per acre (appropriated \$353 and Knutson-Vandenberg

## Reforestation



\$314). The 1988 cost was about 10 percent less than in 1987, reflecting slightly lower contract bid prices.

## Nursery Operations

Eleven bareroot and 2 container nurseries produce high quality seedlings to meet reforestation needs cost-effectively. These nurseries produce seedlings that meet the species and seed-source requirements peculiar to the individual areas to be reforested.

Seedling production costs at 10 of the nurseries are charged to the working capital fund and are in turn repaid as a cost of seedlings in the reforestation program. Production over the past 10 years has averaged 130.3 million bareroot and 5.9 million container seedlings. Production during 1988 was 112.9 million bareroot and 4.8 million container seedlings.

Forest Service seedling production is supplemented through contracts with State and private nurseries, which aver-

aged 28.8 million seedlings per year over the past 10 years and 39.3 million during 1988.

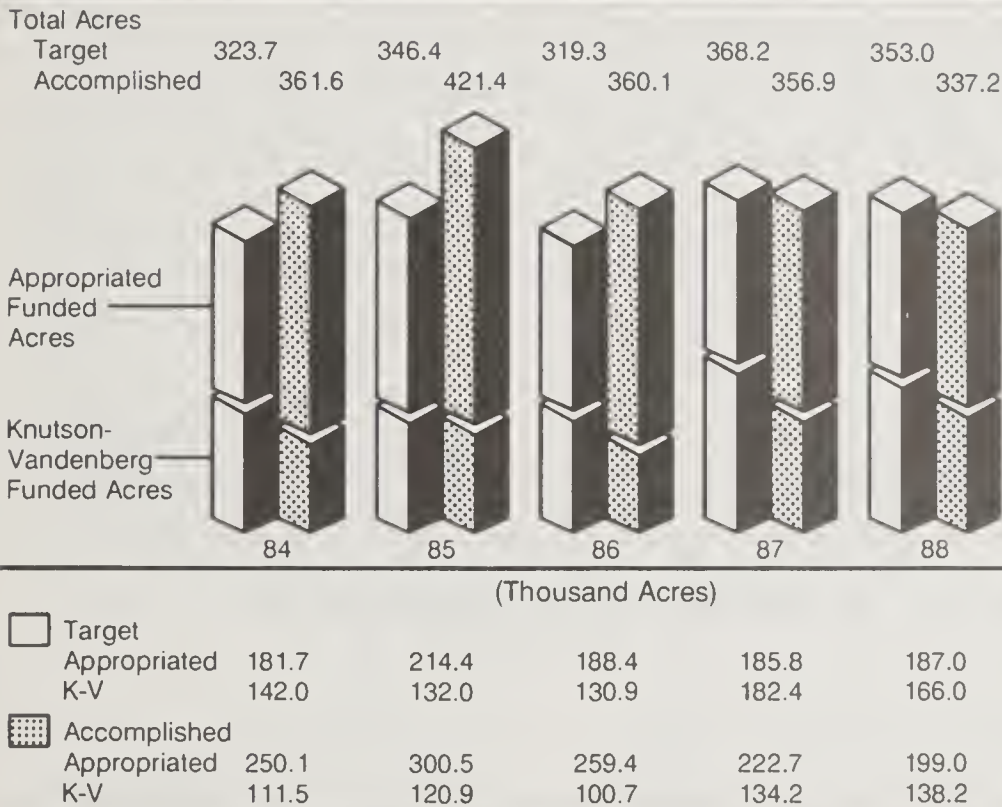
## Timber Stand Improvement (TSI)

A total of 337,182 acres received timber stand improvement treatment. Appropriated funds and the Reforestation Trust funds were used to treat 199,000 acres; K-V funds were used on an additional 138,182 acres (tables 22-24).

Several types of noncommercial treatments can improve tree growth and quality. Indeed, the future usable yield of timber stands can be increased anywhere from 15 to 25 percent with such treatments as thinning overly dense stands, eliminating competing shrubs or weed trees (referred to as "release"), or applying fertilizer to stimulate tree growth. As of October 1, 1988, timber stand improvement treatment had been prescribed for about 1.3 million acres, including reforested stands, to maintain healthy, vigorous growth.



## Timber Stand Improvement



The average cost of all timber stand improvement treatments in 1988 was about \$131 per acre, a 3 percent decrease from 1987. The cost of timber stand improvement funded by K-V increased 1 percent to \$151 per acre because the highest cost regions accomplished a larger percent of the job. Loss of personnel for firefighting led to a reduction of K-V timber stand improvement accomplishment and a corresponding reduction in expenditures.

Tables 19 through 26 provide detailed information on needs, accomplishments, and the certification of reforestation and timber stand improvement.

## Forest Tree Improvement

The tree improvement program is designed to select trees with superior growth or disease-resistance characteristics to produce seed for improved seedlings for the Forest Service planting program. Timber yields should be at least 10 percent greater on lands refor-

ested with genetically improved planting stock.

The Forest Service selected more than 3,487 superior trees, planted 1,029 acres of seedling tests to evaluate the genetic worth of the selections, and established 229 acres of seed orchards to produce improved tree seed. More than 30,000 pounds of seed were harvested in seed orchards this year, accounting for 53 percent of the total amount of seed collected. During 1988, 33 percent of the acres artificially regenerated were planted with improved seedlings grown from seed orchards.

In February 1988, the Forest Service established an electrophoresis laboratory at the Placerville Nursery on the Eldorado National Forest in California. The new laboratory processes seeds and tree samples to provide forest personnel with genetic information about relative amounts and geographic patterns of natural variation. Tests at the laboratory give forest managers the means for evaluating the genetic conse-

quences of stand management practices and tree improvement activities. Forest personnel have access to new quality control measures for many aspects of their on-going programs.

## Timber Sale Program Information Reporting System (TSPIRS)

Following the direction from the Congressional Appropriations Committee's 1985 Conference Report, the Forest Service established a task force to develop, field test, and evaluate accounting and display options for the costs and benefits of the timber sale program. We presented a final report on the development of the Timber Sale Program Information Reporting System (TSPIRS) to Congress in April 1987. This report reflects, among other things, a revised financial accounting system developed in conjunction with the General Accounting Office. In response to a separate request by the House Appropriations Subcommittee on Interior, GAO independently established baseline costs and accrual accounting procedures in addition to other important economic information about the annual sale program. No single financial report can present all the information needed to understand the costs and benefits of the timber sale program. Therefore, TSPIRS contains the following 3 basic accounts to display this information:

- ▼ The Statement of Revenues and Expenses, the financial statement presented in the GAO report to Congress.
- ▼ The Employment, Income, and Program Level Account, presenting the effect of employment, income, and program output levels on local communities.
- ▼ The Economic Account, displaying the long-term costs and benefits, including both market and nonmarket values, associated with the annual program.

The Forest Service is proceeding with implementation of TSPIRS, and in 1988,

every national forest tested the reporting system. The system design is being refined as a result of these tests, and it will be officially implemented on all national forests in 1989. As currently designed, the system provides the financial, economic, employment, income, and program-level perspectives that are important in assessing a forest's annual sale program. Some potential applications for TSPIRS in managing the timber sale program are in the areas of stewardship reporting, public information, accountability, forest plan monitoring, timber sale planning, and programming.

#### **Timber Management Administrative Review Process**

Since its inception, the Forest Service has been committed to having the public review forest officer decisions. Since the 1930's, an administrative review process has been codified in a series of Federal regulations. Managing the national forests for multiple uses creates extremely complex situations, resulting in an unlimited number of alternatives for management action. Opinions, some strongly held and on sensitive, emotional issues, are many and varied. The practice of forestry, because of the inherent requirement for trees to be cut and roads built, has produced a lot of concern over timber sales or timber management in general.

A large number of citizens and citizen groups have used the administrative review process to question management decisions or whether such decisions are in accordance with the National Environmental Policy Act and NFMA or consistent with a Forest's Land and Resource Management Plan. The increase in recent years in administrative "appeals" has been tremendous. Each appeal involves hundreds of hours of work at every administrative level of the Forest Service. The Chief's office currently has an inventory of 60 to 70 active administrative appeals regarding timber sales.

The Forest Service remains committed to the concept of having an administrative review process and to the management philosophy of multiple use/sustained yield. Timber management will continue on those national forests where the practice of timber harvest has been determined appropriate through the forest planning process. Timber sales and other timber management activities will be integrated with the management of other resources, will be accomplished in accordance with NEPA, and will involve an appropriate level of citizen participation. Obtaining understanding, acceptance, and support by the public for continuing the practice of timber harvest on the national forests is key to resolving the appeal situation.

#### **Suspension and Debarment**

During November 1987, the Forest Service implemented a new suspension and debarment regulation. Under this regulation, timber purchasers who are suspended or debarred are prevented from bidding on new timber sales and may not be awarded a timber sale contract during the period of suspension or debarment. The length of debarment may be up to 3 years. The purpose of debarment is to protect both the public and the Government's interests; it is not for the purpose of punishment. Reasons for debarment are varied and may include theft, forgery, bribery, falsification or destruction of records, the making of false statements, receiving stolen property, antitrust violations, and certain contractual violations.

During 1988, 15 companies and individuals were debarred, and debarment has been proposed for another company. In addition, 17 companies and individuals were suspended while debarment action is being considered. By the end of 1988, the suspension and debarment list contained the names of a total of 21 companies and individuals who had been debarred, 1 who was proposed for debarment, and 17 who had been suspended.

## **RECREATION**

The national forests provide more outdoor recreation opportunities and record more recreation visitor use than any other Federal lands. They include 79 percent of the Wilderness System outside the State of Alaska. The trail system is the largest in the Nation, with more than 106,800 miles of trails on which to hike, ride, or cross-country ski. National forests include 3,331 miles of the National Wild and Scenic Rivers System, 14 national recreation areas, and many more geologic, scenic, and botanical areas. The national forests also contain many valuable historic and prehistoric archeological resources. Developed facilities include more than 4,400 campgrounds and 1,400 picnic grounds.

National forests provide information on and interpret these valuable opportunities at 50 major visitor centers. In cooperation with the private sector, the national forests provide more than 40 percent of the downhill ski opportunities in the Nation, as well as the sites for many lodges, resorts, and more than 15,000 summer homes.

#### **National Recreation Strategy**

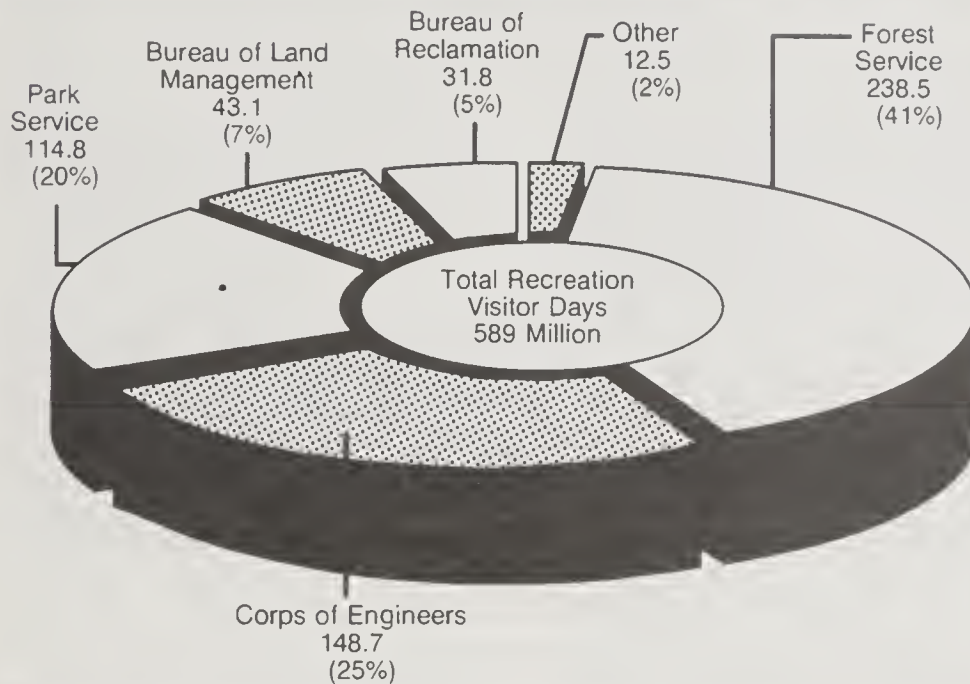
In 1988, the Forest Service launched the National Recreation Strategy in response to the priorities set in recently completed national forest Land and Resource Management Plans. The objectives are to improve customer service and satisfaction, to form partnerships with other agencies and private enterprise, to improve employee knowledge about all phases of recreation management, and to increase public awareness of multiple use management of public lands.

The strategy included developing several demonstration national forest marketing plans. The plans focus on customer satisfaction, emphasizing the importance of serving people in urban areas near national forests. Work



### 1987 Recreation Visitor Days by Federal Agency\*

(Million RVD's)



\*1988 agency data not yet available.

### Recreation Use

In 1988, 242.3 million recreation visitor days (RVD's) occurred on National Forest System lands, a 2 percent increase from the prior year. This 1988 use exceeded the RPA High Bound by 1 percent (table 4). More outdoor recreation occurs on National Forest System lands than on any other Federal landholding. Recent data show that the national forests and national grasslands account for 41 percent of the total RVD's of use that takes place on Federal lands.

In 1988, national forest campgrounds, picnic areas, and swimming sites had 70.2 million RVD's. This amounted to approximately 29 percent of total National Forest System recreation use. Facilities operated by other public agencies or the private sector on National Forest System lands, such as ski areas and vacation cabins, accounted for an additional 13 percent of total visitation.

included designing a national reservation system for recreation customers seeking public camping facilities; starting a "Windows on the Past" program to make more cultural resources available to the public for enjoyment and education; rehabilitating and making more recreation facilities accessible for older Americans and the disabled; and identifying administrative barriers to implementing the strategy.

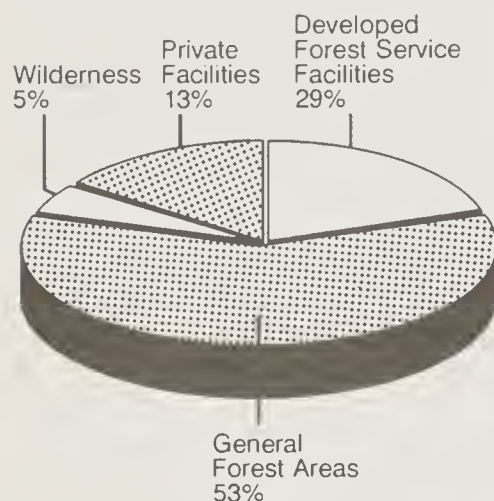
The Forest Service designated \$500,000 for a pilot challenge cost-share program. The Agency found partners who provided more than \$900,000 for recreation improvement projects. Therefore, nearly two dollars were contributed for every dollar appropriated for the program. The partners included local, county, State, and national agencies, private interest groups, senior citizens, disabled youths and veterans, correction facility inmates, students, utility companies, recreation industries, timber operators, interpretive associations, and private businesses. These partnerships stretched the limited Federal funding to help meet the recreation needs of the Nation.



*Customer satisfaction is emphasized with the National Recreation Strategy.*

Photo by Peter Wingle

### Where Recreation Occurs on National Forests



National forest recreation includes a wide spectrum of activities. There are 355,700 miles of road and extensive trail systems for motorized vehicles that provide access to these activities (tables 27 and 28).

Most national forest visitors used these lands, roads, and trails for unstructured, dispersed recreation, such as hiking, hunting, and driving for pleasure. This use accounted for an equivalent of 141 million RVD's, or about 58 percent of total use. Of the total use, 11.8 million RVD's occurred in wilderness and primitive areas.

### Receipts

Total recreation receipts in 1988 were \$34.3 million. This is a 12 percent increase over 1987 receipts. Appropriations for recreation were \$123.7 million. Fees, therefore, recovered 28 percent of total recreation appropriations.

Fees for use of national forest recreation facilities generated \$12.5 million in 1988, compared to \$11.1 million in 1987 and \$10.9 million in 1986. Fees for recreation special uses, derived primarily from ski areas and recreation residences, generated \$21.8 million, compared to \$19.4 million in 1987.



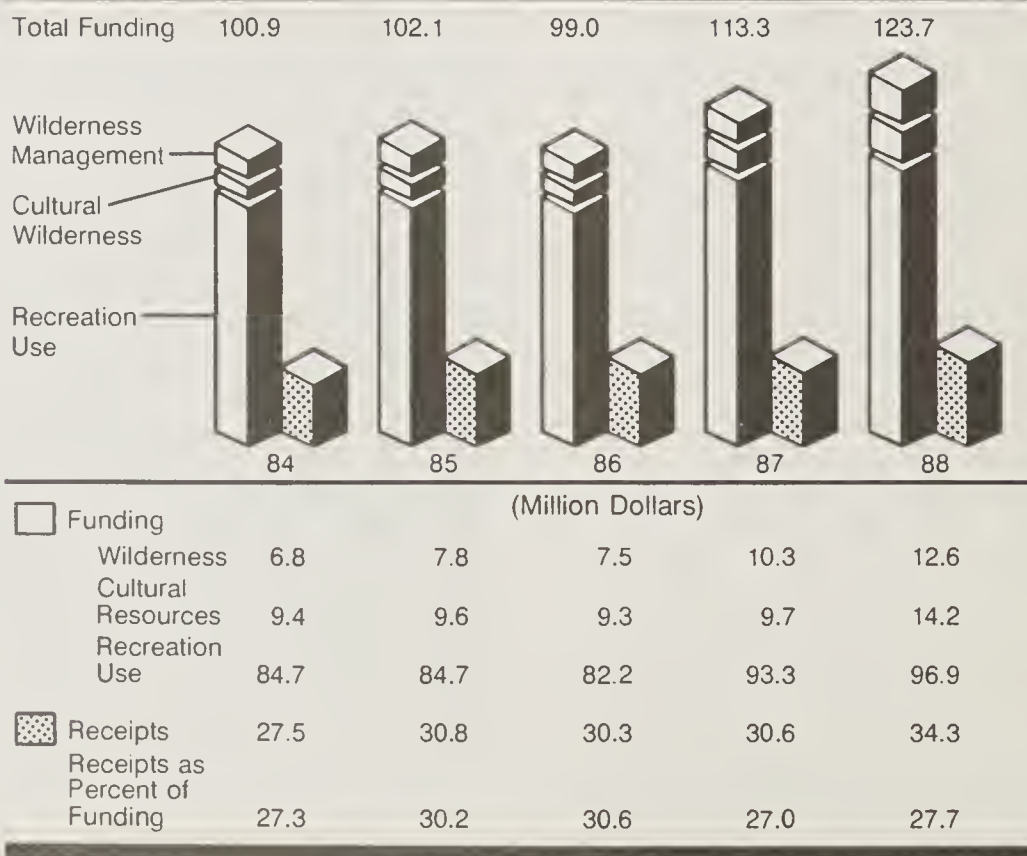
*Recreation areas on the national forests provide solitude for urban dwellers.*

Photo by Jim Hughes

In calendar year 1988, 44 interpretive associations contributed an estimated \$1.2 million to the national forests from

gross sales of \$3.4 million, primarily from the sale of books and maps. Interpretive associations are nonprofit,

### Recreation - Funding and Receipts





public service organizations established to further the interpretation and understanding of resource management on the national forests. Direct services of these associations include visitor center staffing, map and book sales, preparation of an array of publications, and purchase of equipment for interpretive programs.

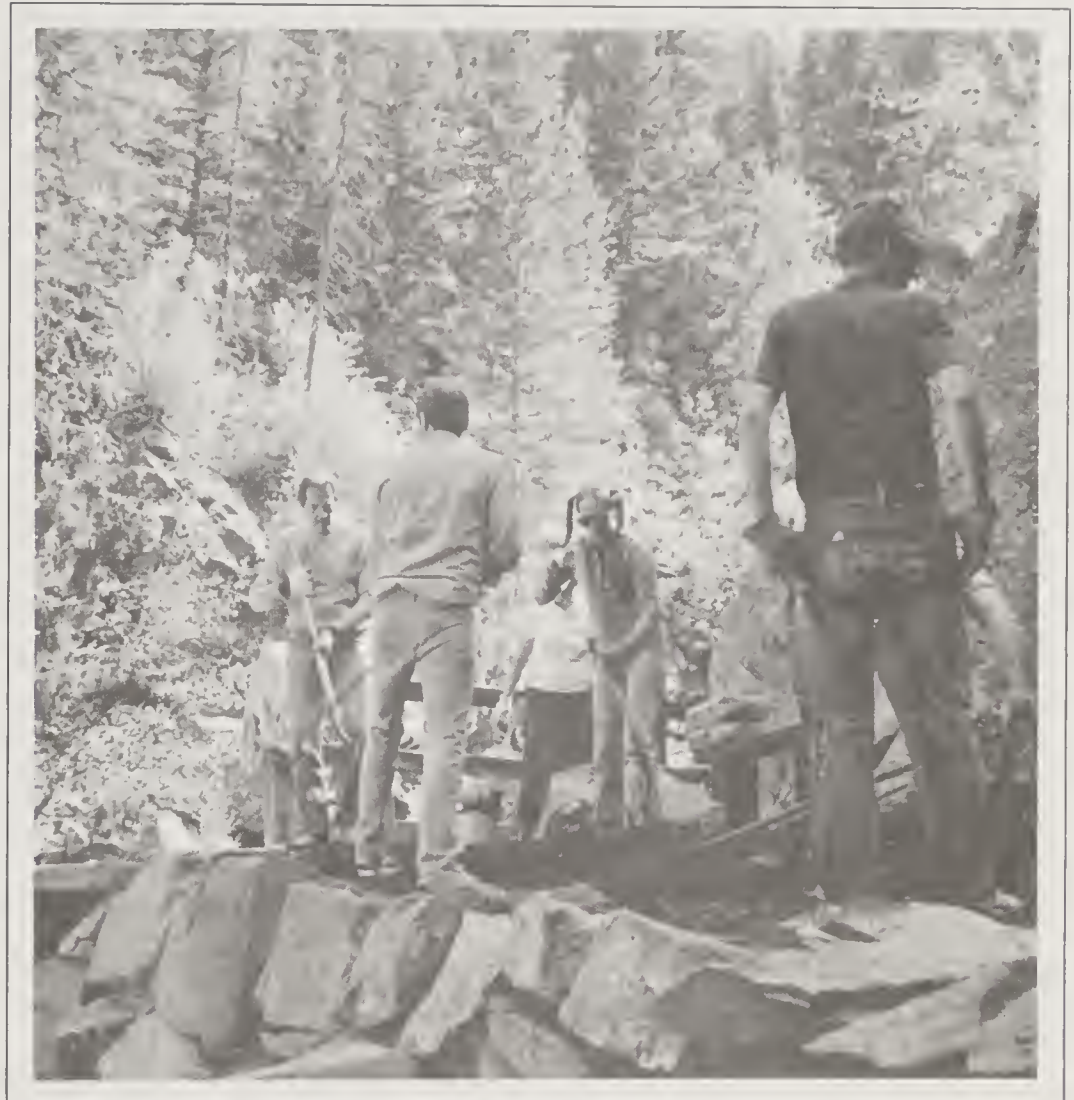
### Trails

The national forest trail system provides opportunities for horseback riders, hikers, motorcyclists, snowmobilers, bicyclists, and disabled visitors. The trail system also is used to access such resource management activities as wildfire suppression and wildlife habitat improvement (table 29). We constructed or reconstructed 1,661 miles of trails, compared to the funded target of 1,134 miles. Most of this work was reconstruction of existing trails, rather than new construction. In addition, 173 miles were constructed through the contributed efforts of volunteers, the Youth Conservation Corps, the Senior Community Service Employment program, and others. Currently there is a backlog of \$87 million in needed trail reconstruction or maintenance. This backlog has resulted from increased use, weathering, and postponing of routine maintenance.

The total trail system now has 106,834 miles, an increase from 95,348 in 1975. We have been building new trails and reconstructing existing trails to take advantage of scenic vistas and historic sites, create loop trails, and provide diverse experiences. The administrative trail system was not designed for recreation needs. Today, however, trail use accounts for about 8 percent of the total national forest recreation use and is a cost-efficient recreation capital investment.

### Scenic Byways Program

In 1988, the Forest Service designated its first National Forest Scenic Byway. The program provides for identification of travel routes that traverse scenic cor-



*Volunteers from the Steamboat Springs Chamber Resort Association rebuild a trail on the Routt National Forest in Colorado. Photo by Sherry Reed.*

ridors of outstanding aesthetic, cultural, or historical value. Scenic byways offer recreational motorists a natural spectrum of typical forest settings ranging from dense rain forests, to northern hardwoods, to mountain tundra and alpine forests.

The first scenic byway was designated on the Cherokee National Forest in Tennessee, followed by the designation of 9 additional scenic byways. The total byways run along 560 miles of scenic highways in 7 States. This program will draw attention to the spectacular scenery of the national forests and provide opportunities for visitors to view well-managed and changing forest landscapes in harmony with forest activities.

### Recreation Facility Management

Historically, as national forests became more heavily used, recreation facilities were built to protect resources and settings as well as to accommodate visitors. These facilities include campgrounds, trailheads, boat ramps, picnic areas, and visitor information centers. The majority of the recreation facilities are more than 20 years old.

These recreation facilities have a combined capacity for 158 million persons-at-one-time (PAOT) days. PAOT days are determined by multiplying a site's designed capacity by the number of days per year that a site is available for use. In 1988, the Forest Service provided 111.6 million PAOT

days, with another 17.7 million PAOT days contributed by human resource programs and challenge cost-share projects.

The total figure, 129.3 million PAOT days, is an increase of 4.3 million PAOT days over 1987. This increase is related in part to a reduction in deferred facility maintenance. Deferred facility maintenance increases the need for repairs, reduces the quality of a facility, and may result in portions of facilities being closed temporarily to reduce operating costs. Such closures are deemed necessary to prevent deterioration from public use and thereby to extend the life of a facility. To the extent that deterioration related to weather and other factors continues, the life of the facility is shortened and the value of the asset depreciated.

Deferred maintenance backlog was reduced about \$10 million to \$284 million for 1988. This backlog represents a serious risk of loss of a major capital

investment in recreation facilities. This need is recognized in the 1985 RPA program.

### Recreation Site Construction

In 1988, Congress appropriated \$18 million for recreation construction. The majority of these funds were used to provide for high-priority recreation facility rehabilitation projects as identified in Forest Land and Resource Management Plans, with emphasis on health and safety-related projects, such as water and sanitation reconstruction. Objectives of this rehabilitation are to increase receipts and recreational opportunities.

### Cultural Resource Management

The Historic Preservation Act of 1966 directs the Forest Service to identify and protect significant cultural resource properties during such land-disturbing activities as road-building, campground construction, and timber harvest. To

meet this direction, archeological surveys are conducted before proposed projects are approved. In 1988, survey sampling was accomplished on 1.9 million acres. These surveys identified significant properties that have cultural, prehistorical, or historical resources. During 1988, 2,601 properties were evaluated. A total of 87 are now on the National Register of Historic Places. An additional 11,774 properties are eligible for listing and will be evaluated in the future.

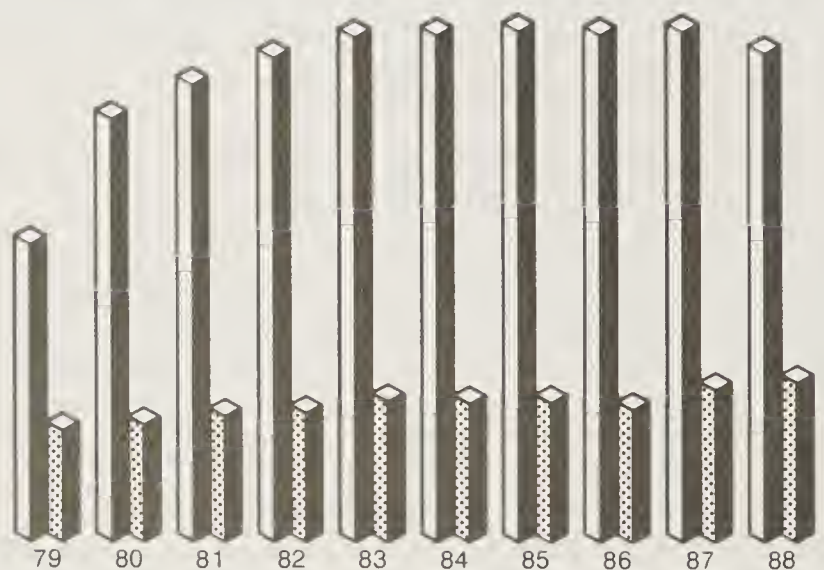
### WILDERNESS

Congress has designated 32.5 million acres of the National Forest System to be managed as part of the National Wilderness Preservation System. There are 354 wilderness areas on national forests in 36 States, with a total land area that is about the size of Alabama. Currently, 1 acre in 6 of National Forest System land is managed as wilderness.

A total of 11.8 million RVD's were recorded in wilderness areas in 1988. This is about 5 percent of the recreation use on national forests. Hunting, fishing, and trapping under applicable State and Federal laws are allowable recreational uses within national forest wilderness areas. Other allowable uses that occur in wilderness areas are outfitting and guiding services; management measures to control fire, insects, and disease; aircraft and motorized use where it existed prior to and is specified in the designating legislation; adequate access to private and State lands; scientific data collection, using methods compatible with protecting wilderness environment; livestock grazing that occurred prior to designation; and mineral exploration and development under specific legal situations.

Our congressional mandate is to preserve an enduring resource of wilderness, where natural processes are allowed to operate freely and humans are visitors who do not remain. Wilderness is managed to provide for scientific, scenic, educational, conserva-

### Recreation Rehabilitation Backlog



Backlog	176	248	268	283	294	296	297	296	294	284
Funding	70	73	78	79	86	85	85	82	93	97



tion, historical, recreational, and other uses that are consistent with wilderness resource protection. Such wilderness characteristics as solitude, unconfined opportunities for recreation, and experiencing land in its primeval state are protected.

To protect the wilderness resource, the Forest Service:

- ▼ Educates users on wilderness values and how to protect these values.
- ▼ Enforces regulations established to protect wilderness values.
- ▼ Rehabilitates damaged areas.
- ▼ Maintains inventory data for wilderness uses and resource conditions.
- ▼ Prepares and implements plans based on inventory data for protecting the wilderness into the future.

The wide variety of activities occurring in wilderness areas and sanctioned by law demonstrates the challenges facing the Forest Service as wilderness managers. Wilderness is not a block of land that is "left alone" to let nature take its course. Human activity is occurring in wilderness every day. The challenge is to maintain the intent of Congress to protect the wilderness environment with management practices that allow natural processes to be unaffected by our human presence in the wilderness. Maintaining wilderness as an area "affected primarily by the forces of nature, where man is a visitor who does not remain", happens only with a great deal of effort. This is a joint effort by the Agency, other wilderness-managing agencies, users of the wilderness, volunteers working in the wilderness, and organizations that support protection of wilderness resource values.

## WILDLIFE AND FISH

The National Forest System contains the greatest diversity of wildlife, fish, and plant species of any single land ownership in the country. Our goals are to maintain ecosystem diversity and productivity to ensure a quality environment and meet demands for recreational and

### 1988 Wildlife and Fish User Days



commercial uses of fish and wildlife. We do this through a variety of techniques to protect, restore, and improve plant and animal habitats within the National Forest System.

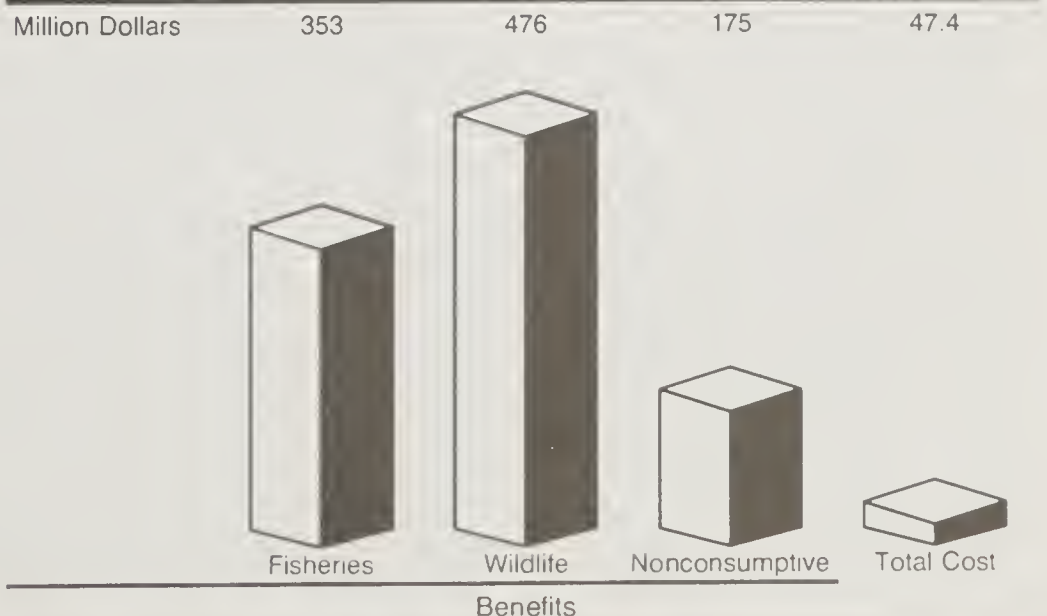
Wildlife and fish resources of the National Forest System provided over 41 million user days of recreation for hunters, anglers, and nonconsumptive wildlife and fish uses. User days for

fishing and hunting were obtained from recreation information management data, and values for nonconsumptive uses came from the Resources Planning Act (RPA) assessment. This represents about 17 percent of all recreation on national forests. According to RPA assessment information, the value of hunting provided on national forests is estimated at \$476 million, the value of fishing at \$353 million, and the value of nonconsumptive wildlife and fish uses at \$175 million. Congress appropriated \$47.4 million in 1988 for management to sustain and increase these benefits.

The Forest Service cooperates with State fish and wildlife agencies in developing and implementing statewide comprehensive plans to manage animal populations. Habitat is managed for several reasons, including production of game species, protection of endangered species, enjoyment of nongame species, and benefits that all types and groups of national forest users receive from overall management of the forests.

Sound habitat management sustains the biological diversity of the Nation's major forest systems. It provides for recovering populations of threatened and endangered species; maintaining viable

### Wildlife and Fisheries Benefits and Costs in 1988







*Members of California's Department of Fish and Game work with the Forest Service on fish habitat improvements. Photo by Roy Murphy*

populations of all native vertebrates; protecting special habitats, such as old-growth forest, riparian areas, trout streams, snags, and wetlands; and ensuring productivity of selected species, such as elk, deer, turkeys, bass, and salmon, for recreational and commercial uses. Conservation programs are developed jointly with State wildlife agencies and major fisheries and wildlife conservation groups. Some examples include "Join Us," an initiative to strengthen public-private partnerships in wildlife and fisheries management; "Rise to the Future," a national fishery initiative to provide emphasis on habitat enhancement; "Taking Wing," a waterfowl and wetland initiative to enhance habitat and support the North American Waterfowl Plan; and "Animal Inn," a program to communicate the importance of managing dead standing and fallen trees for wildlife habitat.

#### **Wildlife and Fish Habitat Improvement**

Many forest plans call for increases in wildlife and fish habitat productivity to meet growing demands for recreational, commercial, and subsistence uses.

During 1988, the Forest Service managed habitats to maintain current levels of wildlife and fish production in concert with other resource programs. We used appropriated funds to improve 154,091 acres of habitat, which was 64 percent above the funded target. Accomplishments exceeded the funded level due to

the success of partnership efforts such as the challenge cost-share program.

We used Knutson-Vandenberg Act funding from timber harvest receipts--a significant source of funds for wildlife and fish habitat management--to restore or improve the quality of an additional 200,539 acres of habitat that were affected by timber harvests.

The following are some examples of habitat improvement activities that the Forest Service accomplished in cooperation with States and other Federal agencies:

- ▼ The Tahoe National Forest, jointly with the California Department of Fish and Game, improved 64 acres of meadows to increase habitat productivity for a variety of fish and wildlife species. The improvements included planting willows, fencing, installation of erosion control check dams, and control of people access.
- ▼ For the second year, the Siuslaw National Forest, Oregon Department of Fish and Wildlife, and Rocky Mountain Elk Foundation seeded and fertilized clearings at old homesteads to improve forage for elk.



*This waterhole for wildlife became a reality when the Wild Turkey Federation provided \$5,725 and the Appalachian Forest Management Group donated dozer time and labor to improve wild turkey habitat on the George Washington National Forest. F.S. Photo*



- ▼ Forest personnel, in cooperation with Virginia Department of Game and Inland Fisheries, are reintroducing peregrine falcons on the George Washington National Forest. The birds had vanished from the Shenandoah Valley in the early 1950's. This year, 12 birds were released in the Forest.
- ▼ In partnership with Illinois Department of Conservation, the Shawnee National Forest improved wintering habitat for over 50,000 ducks. Project work included disking and seeding 229 acres, mowing 1,005 acres of wildlife openings, prescribed burning of 170 acres, and improving 89 watering holes.
- ▼ Recovery of the endangered Gila trout continues with introduction into Trail Canyon on the Gila National Forest. The Forest Service carried out this work in cooperation with the New Mexico Department of Game and Fish, New Mexico State University, and the U.S. Fish and Wildlife Service.
- ▼ A cooperative fisheries project on the Big Thompson River, involving Trout Unlimited, Colorado Division of Wildlife, and the Arapaho-Roosevelt National Forest, has nearly doubled fish productivity in the restored areas. Restoration work included the construction of 44 habitat improvement structures in 7 sections of stream and the planting of willow shoots to accelerate natural revegetation on streambanks.
- ▼ The Eldorado National Forest, in cooperation with the Eldorado County Fish and Game Commission, the California Department of Fish and Game, and California Trout, completed spawning habitat improvements for brown trout in Gerle Creek, a popular fishing area near Sacramento. An access trail to Gerle Creek for handicapped anglers also was completed.

- ▼ The Monongahela National Forest completed phase one of a cooperative project to restore fish habitat in Gandy Creek, which was devastated by flooding in 1985. The project involved the West Virginia Department of Natural Resources and Trout Unlimited. Production in the restored habitat is expected to increase by 70 pounds of trout per mile and over 250 angler user days annually.
- ▼ The Stikine Area of the Tongass National Forest constructed a 120-foot Alaska "steppass" fish ladder for coho salmon at Slippery Creek. This interagency project involved the Alaska Department of Fish and

Game, the Northern Southeast Regional Aquaculture Association, and the Forest Service. Over a 25-year period, the improved access for fish will provide approximately \$4 million in benefits to commercial, sport, and subsistence users.

#### **Partnerships for Habitat Improvement The Challenge-Cost Share Program**

Congress authorized \$2 million in 1988 to continue the fish and wildlife challenge cost-share program. The goal of this program is to maintain and enhance wildlife and fish resources on the national forests through active partnerships with conservation organizations, State and Federal agencies, and private indi-



*Fisheries improvements include installation of this aluminum steppass ladder. FS Photo*



viduals. The challenge cost-share projects included improving forest habitat for such wildlife as deer, elk, grouse, moose; nongame species such as songbirds; improving several thousand miles of fisheries habitat; reintroducing peregrine falcons; building nest boxes; seeding around waterholes for wildlife food and cover; placing bass spawning boxes; and conducting surveys to establish protective measures for endangered species.

This year, there has been a tremendous increase in both the amount and type of partnerships that have been developed through this program, including many conservation groups, civic groups, corporations, the Boy and Girl Scouts of America, and private individuals. The Rocky Mountain Elk Foundation, Trout Unlimited, the National Wild Turkey Federation, and various State fish and wildlife departments are a few examples of partners with the Forest Service in this program.

Partners for 1988 numbered approximately 430, an increase of more than 100 percent over last year's participation. These talented partners were able to turn their efforts into an investment of more than \$4 million--a ratio of more than 2 to 1 to the challenge cost-share funds. This translates into quite a savings for the American taxpayer and also into tremendous benefits to both the national forest users and to the fish and wildlife located there.

An example of a successful challenge cost-share project is the Pactola Basin Stream Habitat Improvement Project on the Black Hills National Forest. This was a 3-year multiphase cooperative project involving the South Dakota Game, Fish, and Parks Department and the Forest Service. The project improved fish and riparian habitat around Rapid Creek within the Pactola Basin; restored a naturally reproducing population of wild trout; increased tall woody vegetation by planting willows for streamside shading; maintained wildlife habitat to perpetuate existing big game populations; increased herbaceous for-



*Brush and other vegetation is dropped into this lake to build a structure that will increase aquatic habitat diversity and improve hiding cover for fish. F.S. Photo*

age by 400 percent; provided trailhead parking and stream crossings for hiker access to Centennial Trail; and increased angler user days by 267 per year.

### **Wildlife and Fisheries Habitat Relationships**

During 1988, we made significant progress in applying the information, methods, and technology of the Wildlife and Fish Habitat Relationships (WFHR) system to enhance consideration of wildlife and fisheries resources in national forest planning and management. An important focus of WFHR, the improvement of inventory methods and habitat evaluation procedures, makes it possible for more accurate assessments of existing and potential habitat capability. WFHR approaches and methods are helping address important problems that pertain to conserving biological diversity, managing viable populations, and producing wildlife and fish to meet public demand. With implementation of Forest Land and Resource Management Plans under way, the current emphasis of WFHR is to provide needed information and technology to support project planning, cumulative effects analysis, and monitoring.

Wildlife and fish habitat models are one important WFHR product, and several new ones have been developed as part of regional WFHR programs. The Muskellunge Lake Reproduction Model, which includes a cost-and-benefit analysis, is being used to support lake management decisions. The Alaska Region is developing habitat capability models and cumulative effects models for fish species. The region also is completing models for terrestrial species. For example, a habitat suitability model was developed to identify and evaluate habitat for breeding bald eagles. The Rocky Mountain Region makes routine use of habitat capability models to guide land management activities and evaluate treatments for selected wildlife species.

Other models function in cumulative effects analyses (long-term evaluations of the effects of forest management) on endangered and threatened species and in economic evaluations. Our cooperators, such as State fish and wildlife departments and Indian tribes, often use WFHR models and methods to develop comprehensive plans for wildlife and fish.



### Threatened, Endangered, and Sensitive Species Management

Funding for habitat improvement of threatened, endangered, and sensitive species increased from \$3.5 million in 1987 to \$4.5 million in 1988. This provided for additional habitat improvement and recovery projects. Additionally, \$3.4 million of habitat improvement and recovery tasks were accomplished through the challenge cost-share program.

National forests and grasslands are home to 166 plant and animal species listed by the U.S. Fish and Wildlife Service as threatened or endangered. The Fish and Wildlife Service has approved recovery plans for 81 of these species. The forests use these plans to guide recovery activities. The Forest Service considers approximately 900 species to be sensitive and gives them special management considerations.

We are giving national emphasis to the bald eagle, peregrine falcon, grizzly bear, Puerto Rican parrot, red-cockaded woodpecker, spotted owl, and the Mount Graham red squirrel. Species receiving regional emphasis are the mountain caribou, Kirtland's warbler, Lahontan cutthroat trout, and Gila trout. The Gila trout, Gila topminnow, and Lahontan cutthroat trout are being considered for removal from endangered or threatened status as a result of the cooperative management enhancement programs. Western regions involved with grizzly bear recovery are implementing a long-range management program, titled "Charting the Course--The Forest Service Grizzly Bear Conservation Program."

Work to protect sensitive plants included completion of recovery tasks for several threatened and endangered plants, as well as update of regional data bases on sensitive plant species. The Intermountain Region completed a technical report supporting delisting of the threatened plant, *Astragalus perianus*.

### RANGE

The Forest Service manages range vegetation, in both forested settings and on open rangelands, to provide forage for domestic livestock, wild horses, burros, and wildlife; and for watershed protection, wildlife habitat, recreational opportunities, habitat for threatened and endangered species of plants and animals, and open spaces. The type of range vegetation, its quality or condition, and relative abundance affect water quality and quantity, soil productivity and stability, and aesthetic quality.

In addition to managing for forage production, range conservationists provide their vegetation management expertise to a variety of other national forest programs, including wildlife, watershed, timber, and recreation.

Public concerns about range condition, the spread of noxious weeds, impacts of forest plan decisions, and increasing competition between uses are among the challenges addressed by "Change on the Range," the theme for several actions undertaken in 1988 to respond to change and to provide new direction for the range program. General Accounting Office reports on overstocked allotments and riparian areas underscored these concerns.

In 1988, the Forest Service issued new program policy, objectives, and responsibilities that recognize multiple range values and delegate more management authority to local offices. Proposals for new measurements to better describe range health, an integrated ecological approach to vegetation analysis, and streamlining grazing permit procedures helped a growing constituency focus its attention on the management of range vegetation. New range management measures will be incorporated in future annual reports.

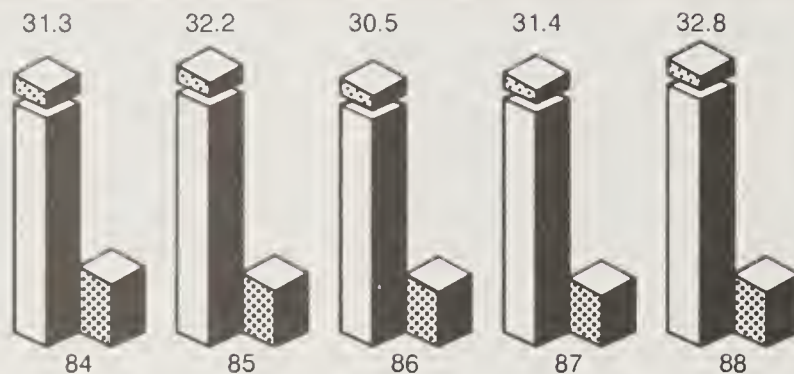
The range program was funded at \$32.8 million (including the Range Betterment Fund) in 1988 and returned \$8.7 million to the Treasury from grazing fees. Based on the existing Presidential formula, the grazing fee for the national forests in the sixteen Western States was raised to \$1.54 per head month on March 1, 1988. For grazing fee purposes, a head month is a month's use and occupancy of range by one weaned or adult cow, bull, steer, heifer, horse, burro, mule, 5 sheep, or 5 goats. Ten percent of the total receipts came from grazing on national grasslands and land utilization projects in the Plains States and Eastern National Forest System range. Grazing values from these areas ranged from \$0.54 to \$2.28 per head month in 1988.






*Range vegetation provides forage for livestock, together with soil and water protection, wildlife habitat, and open spaces.* Photo by Del Mar Jaquish

### Range - Funding and Receipts

Total Range  
Funding



(Million Dollars)

	Range Management Funding	27.3	28.2	26.9	27.6	29.2
	Range Betterment Funding	4.0	4.0	3.6	3.8	3.6
	Grazing Receipts	9.6	9.0	8.6	8.1	8.7
	Receipts as Percent of Funding	30.7	28.0	28.2	25.8	26.5

Nearly 104 million acres, 54 percent of all National Forest System lands and located in 35 States, are divided into 9,868 range allotments that are managed for forage production. The acres in each allotment are further classified as suitable or unsuitable for livestock grazing, with about 48 percent of the 104 million acres classified as suitable.

#### Livestock Grazing

In 1988, the Forest Service administered 13,737 paid permits for 9.9 million animal unit months (AUM's) of grazing by domestic cattle, horses, sheep, and goats. (An animal unit month is the amount of forage needed to support a mature 1,000-pound cow or its equivalent for one month.) Permitted AUM's were the same as 1987 and were slightly above the 1988 RPA program level of 9.8 million AUM's. Total permitted AUM's are expected to decline as forest plans are implemented and program funding remains static.

#### Range Condition

In managing range vegetation, the first priority is to maintain or improve its productivity and condition. About 78 percent of the 50 million suitable acres in grazing allotments are in satisfactory condition. The soil is adequately protected and forage species composition and production are at acceptable levels or on an acceptable trend.

#### Noxious Weeds

According to current estimates, various species of noxious weeds infest 4.9 million acres of National Forest System lands in the Western States, and they are continuing to spread. Weeds create a management problem that affect many resource values, such as wilderness, soil, aesthetic quality, and land values, as well as the forage supply and its nutritional value for wild and domestic animals. Controlling the spread of noxious weeds depends on coordinated

efforts by all landowners in an infested area.

In cooperation with local weed control districts, the Forest Service treated 21,212 acres of National Forest System lands in 1988, exceeding the funded target by 10 percent. In addition to weed treatments accomplished with appropriated funds, another 946 acres were treated using contributed funding and labor.

#### Range Improvements

Range improvements affect range condition, wildlife habitat, and soil and water quality, and protect watersheds and fragile areas while providing for sustained use. In consultation with range users and other resource interests, the Forest Service identifies needed forage and structural improvements that will protect vegetation and other range resources and lead to better distribution of grazing and foraging animals. About 2,700 structural improvements, such as fences, water developments, and pipelines, were constructed with appropriated funds, exceeding the funded target by 19 percent. Range forage improvement work, such as prescribed burning, seeding, and mechanical treatments, was completed on 53,446 acres, under the funded target by 9 percent. An additional 326 structures and 22,198 acres of forage improvement were completed with Knutson-Vandenberg Act (K-V) funds.

In addition to improvements accomplished with appropriated funds, 154 high-priority structural improvements and 1,262 acres of forage improvement work were accomplished with donated labor, funds, and materials supplied by cooperating permittees, other agencies, and volunteers.

#### Wild Free-Roaming Horses and Burros

The Forest Service estimates that 1,225 wild horses and 350 wild burros are the appropriate management levels for the 45 wild horse and burro territories on



National Forest System lands. In 1988, 97 excess wild horses and burros were captured and made available for adoption.

## SOIL, WATER, AIR, AND WEATHER

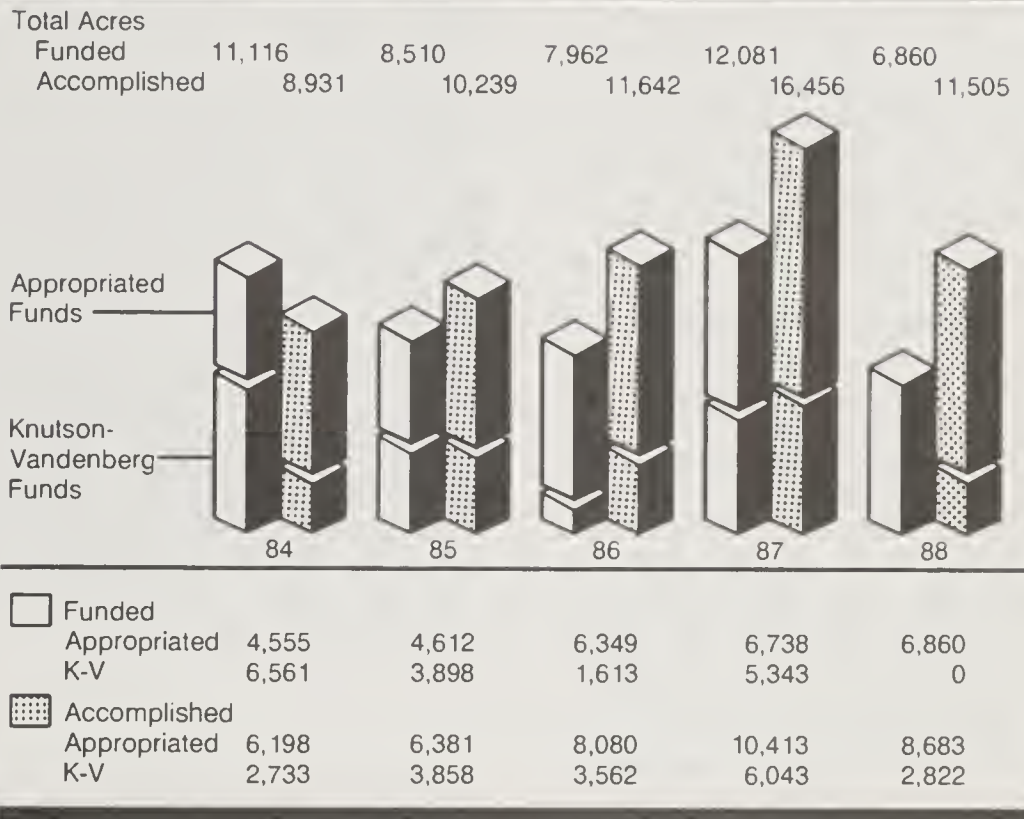
The objectives of the soil, water, and air management programs are to provide water of suitable quality and quantity to meet public needs and resource requirements, to ensure the continued production of natural resources by protecting and enhancing soil productivity, to protect National Forest System land and adjacent airsheds from adverse effects of air pollution, and to provide weather information for resource management and protection.

### Soil and Water Resource Improvement

During 1988, the Forest Service improved the soil and water conditions on a total of 11,505 acres. Appropriated funds were used to improve watershed conditions on 8,683 acres. This is 127 percent of the funded target and 112 percent of RPA Low Bound target. Total improvements exceeded planned targets because of additional acreage completed by human resource programs, more favorable unit costs through contracting, and additional work accomplished through the timber sale program.

Knutson-Vandenberg funds from timber harvest receipts provided improvements on 2,822 acres in 1988. Many cost-effective improvements were made on timber sale areas to correct and improve watershed conditions. Some examples include restoration of eroded gully networks, establishment of vegetative cover on bare soil, and obliteration of old abandoned roads. These improvements increase infiltration of water into the soil and reduce overland flow of water that removes soil and reduces productivity.

### Watershed Improvements, Acres



A total of 459 acres of abandoned mined lands were restored through the Surface Mining Control and Reclamation Act and other State funding sources. Human resource programs and volunteers improved watershed conditions on another 1,110 acres of mined areas. Watershed conditions were improved coincident with various range, wildlife, and fish habitat improvements, such as fencing to control livestock, establishing fish pools, and reseeded.

### Soil and Water Inventories

In 1988, the Forest Service completed soil inventories on 4.8 million acres, compared with 10.3 million acres in 1987. This reduced level is due primarily to the completion of major inventory work on the Tongass National Forest. Soil inventories provide information about soil suitability and productivity, erosion, and stability problems, plus the baseline information needed to monitor

changes caused by management actions. Most Forest Service soil inventories are conducted as part of the National Cooperative Soil Survey. This information is vital for determining what activities can take place on the land and what special management requirements may be necessary to avoid damage to soil and water resources.

The Forest Service also completed inventories to assess the condition of watersheds for maintaining water quality, timing of water runoff, and preventing floods. More than 1.2 million acres were assessed in 1988. In addition to watershed inventories, stream channels were classified and conditions were assessed for 17,600 miles of streams. These inventories provide information for improving the management of riparian areas, minimizing effects of activities that diminish water quality, and helping prioritize improvement needs. The Northern and Intermountain Regions



inventoried 30 percent of the water uses and needs on the Snake River in response to the State of Idaho's effort to quantify water uses. These inventories include water needs for fish, recreation, wildlife, timber, watershed, and range. The Rocky Mountain Region completed the water uses and needs inventory in Colorado Water Division IV in response to State adjudications.

### Nonpoint Pollution Management

In 1988, the Forest Service approved an integrated management strategy to control nonpoint sources of pollution from land management activities. Water quality regulations are being developed by States under Section 319 of the Clean Water Act for nonpoint sources. The Forest Service strategy for minimizing nonpoint source pollution includes design and application of best management practices, monitoring to ensure practices are implemented and effective, and mitigation and adjustment where unacceptable impacts are found. Agency personnel are working with State agencies to formulate cooperative agreements that identify the authorities and responsibilities of the Forest Service and the States for preventing nonpoint pollution. Such agreements have been consummated with the States of California, Washington, and Oregon.

The Northern and Intermountain Regions completed handbooks that guide the design and selection of best-management practices. These handbooks have been incorporated by reference into Forest Land and Resource Management Plans as non-point pollution prevention guidelines.

Nonpoint source monitoring is a significant component of nonpoint pollution management. For example, on the Ouachita National Forest in Arkansas, water-monitoring stations were established below 21 timber stands where herbicides were being applied. Water samples were taken after application and subsequent rainfall-runoff periods. The movement of herbicides was corre-



*The Sawmill Canyon drainage on the Cibola National Forest prior to watershed improvement.*  
F.S. Photo



*A gabion check dam installed in the Sawmill Canyon drainage will retain sediment and aggrade the channel upstream. Results are improved watershed condition, improved fish habitat, and a reduction of sediment in the Bluewater Reservoir.* F.S. Photo

lated with the application methods and the locations of herbicide mixing sites. Based on monitoring information, application practices were modified to maintain water quality. In another example, on the Chugach National Forest in

Alaska, the effects of placer mining on anadromous fish streams were monitored. The results led to requiring additional sediment collection ponds to help ensure that water quality standards were met on these mining operations.



## Riparian Management

Riparian areas comprise about 1 percent of the land base in the western United States. They are key to productive fisheries and wildlife habitat, diversity of scenery and recreation sites, flood reduction, quality water for downstream users, continued recharge of ground water, and sustainable forage production for livestock, wildlife, and wild horses and burros. These beneficial uses and values depend on healthy riparian conditions; conditions that also provide a good indication of the overall health of the land and its resources.

The Forest Service is continuing efforts to assess and improve riparian areas. Forest plans contain guidelines and standards to maintain and improve these productive areas. Regions are developing forest plan implementation approaches that stress riparian values. An example is the Intermountain Region's Riparian Action Program 1988-1992, which outlines goals and objectives for improving riparian areas.

The Pacific Southwest Region initiated a program to increase volunteer participation in restoring streams and wetlands. This program, called Adopt a Stream, develops a partnership among the Forest Service, individuals, organizations, and industry to not only restore the lands but also increase public understanding of natural processes.

## Emergency Watershed Rehabilitation

The Forest Service applied emergency rehabilitation measures to 175 acres of flood-damaged watersheds under the authority of the Agriculture Credit Act of 1978. These emergency measures were taken to protect lives and property downstream and to reduce further damage to resources. Plans for rehabilitating fire-damaged resources are discussed in the special fire section under State and Private Forestry in this report.

## Air Resources

A group of distinguished scientists and selected Forest Service land managers developed a screening guide for reviewing potential new sources of air pollution that could adversely affect the 88 national forest wilderness areas congressionally designated as class I Airsheds. This guide, and the development of an additional technical training course, further strengthen the air management program that was set up last year. To evaluate resource effects and the need for protection, the Agency monitors air quality characteristics such as visibility and sites such as sensitive aquatic habitats, at 38 sites nationwide. Also, the Forest Service portion of the interagency monitoring of protected visual environments, a state-of-the art visibility monitoring program, is now fully operational.

## Weather Program

The weather program coordinates the management of approximately 300 Forest Service remote automatic weather stations to help ensure accurate and reliable data for input to the National Fire Danger Rating System and to the data base for multiple resource management use. To assist the Forest Service and other agencies involved in weather data collection, the program coordinated the development of the final draft of a weather station handbook, "A Guide for Operators and Managers."

The Forest Service completed a comprehensive service-wide weather information and communications needs assessment. We selected the system design and drafted the functional specifications for a new weather information management system that will gather, process, distribute, and store weather information.

## Resource Coordination

The Forest Service accomplishes most soil, water, and air objectives by incorporating them into integrated management programs and projects.

This is done by designing conservation practices that avoid resource damage, maintain long-term soil productivity, control nonpoint sources of pollution, and maintain riparian values and air quality. Approximately 32 percent of soil, water, and air funds were spent on such resource coordination.

## Monitoring

The Forest Service monitors soil, water, and air resources to determine whether resource prescriptions are properly designed and implemented and to evaluate their effectiveness in meeting management objectives. For example, monitoring of the Bradfield River area on the Tongass National Forest, has shown that very little disturbed area remains in the watershed 13 years after a decade of logging activities.

Data on cobble embeddedness is being collected within a number of Idaho forests to evaluate using embeddedness of stream bottom cobbles as a way of reflecting changes to fish habitat. These data are being coupled with information collected by the State and may result in changes to State water quality standards.

The Flathead National Forest entered into a cooperative agreement with the Montana State Forester, the University of Montana, timber industry, and the Montana Environmental Quality Council to develop a program to monitor the effects of land management practices on water quality and fish habitat. The field studies will begin in 1989. This effort will complement a broader initiative to reduce cumulative effects of management activities.

## FACILITIES

More than 21 million square feet of space in approximately 11,200 buildings and related support facilities provide the workspace and storage required by the staff, equipment, and supplies of 852 administrative units over 46 States and Puerto Rico.

The Government owns 78 percent of these facilities and leases 22 percent. Because our mission usually requires long-term tenure in a location, ownership is often more cost-effective. Owned facilities are constructed to replace high-cost leased facilities whenever analysis shows that cost savings would result.

Facilities construction and replacement funds are continuing funds; thus, projects may start one fiscal year and be completed in another. During 1988, we completed projects on several offices, warehouses, barracks, work centers, and water systems. Several projects were started, including office replacements, work centers, crew quarters, warehouses, and water systems.

Maintenance funds provided during 1988 allowed for the continuation of a modest program of abatement of safety and health problems, preservation of historical sites, and other critical problems, such as access for the handicapped. Very little progress has been made on the large backlog of maintenance needs, such as replacing roofing, siding, tiles, and painting.

## ROADS

The Forest Development Road System provides the principal access to National Forest System lands to facilitate implementation of decisions reached in the land and resource management plans. At the end of 1988, the Forest Development Road System was 355,700 miles. The increase from 1987 includes recent new construction and old existing roads not previously included in the updated inventory. This system is managed to provide safe, cost-effective travel and to provide access to manage and protect the national forest resources. The system serves all resource management programs. Roads provide access for many recreation activities, such as camping, hiking, hunting, boating, fishing, and pleasure drives. They also provide access for fire suppression; removal of

energy resources, such as oil, gas, coal, and firewood; mineral extraction; timber harvest; livestock grazing; reforestation; timber stand management; and wildlife and fishery habitat improvement work.

Each road in the transportation system is constructed, maintained, and operated according to its functional classification: arterial, collector, or local. Arterial roads provide access to large areas of land and serve many resources. They usually connect with other arterial roads or public highways. Collectors are intermediate links that provide access to major land masses within the forest and link the local roads to the arterials. Local roads provide access for low volumes of traffic from the collector roads to specific land and resource sites.

## Construction and Reconstruction

During 1988, the Forest Service constructed or reconstructed a total of 7,083 miles of road and 65 bridges at a total cost of \$283.8 million, including engineering and program support costs. These figures do not include work accomplished under the Tongass Timber Supply Fund. Forest road funding

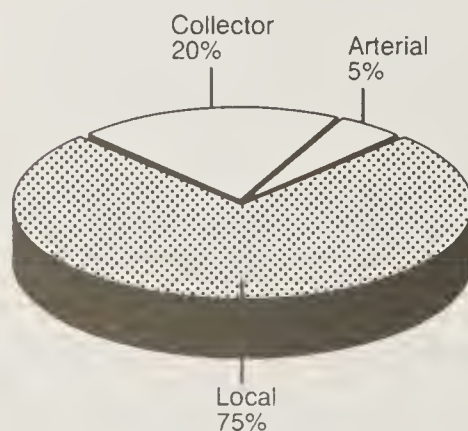
comes from three sources: the Purchaser Credit Program, which allows a timber purchaser to build roads and receive credit equal to the value of those roads to be applied toward the purchase of the timber; the Purchaser Election Program, which allows small purchasers to have the Forest Service build roads funded from timber payments; and the Forest Road Program, which provides for building roads and engineering and support activities with appropriated funds. Of the total 7,083 miles of roads constructed or reconstructed during 1988, 2,037 miles were constructed and 3,693 miles were reconstructed using the Purchaser Credit Program or the Purchaser Election Program funds. The Forest Road Program provided for the construction of 274 miles and the reconstruction of 1079 miles.

We also constructed or reconstructed an additional 39.4 miles of road and 65 bridges through the Tongass Timber Supply Fund at a cost of \$17.5 million.

The typical forest road project in 1988 was the construction or reconstruction of low-standard (single-lane, 12 to 14 feet wide, dirt or gravel surfaced) local roads to provide access to timber. In the future, these roads will also be used for managing and enjoying other resources. Most arterial roads are in place. The same is generally true for collector roads, except in the few forests with large unroaded areas where some new construction is required to implement decisions made in forest plans.

The 99th Congress directed each region of the Forest Service to reduce the average unit cost of timber road construction in 1987 to 5 percent below 1985 levels. In response, we instituted cost saving measures that resulted in cost reductions of 9 percent. Efforts to reduce road construction costs continued through 1988. The average unit cost as compared to 1985 continued to show a reduction, amounting to 4 percent. However, compared to 1987, our 1988 unit costs increased by 6 percent. This increase was partially due to low unit cost restoration reconstruction projects

**Road Function  
Percent of Total System**





*The majority of our transportation system consists of local roads—75 percent. They are normally single-lane with dirt or gravel surfaces designed for slow speed traffic and provide limited vehicle access.*

Photo by Sam Frear



*Collector roads are normally single-lane gravel-surfaced roads that provide all-weather access. They make up only 20 percent of the total system and provide a moderate level of comfort and convenience to the traveler.*

Photo by Rebecca Nisley



*Arterial roads make up a very small part of the Forest Development Road system, approximately 5 percent. They are generally double-lane paved roads that provide for convenient, comfortable, and fast travel.*

F.S. Photo





### Typical National Forest Road System



being done through road maintenance. In 1988, Congress transferred \$10 million from the Forest Road Program to road maintenance for this purpose. From 1987 to 1988, a 5 percent increase of the Forest Road Program funds were used to construct and reconstruct recreation and general purpose roads. These roads normally require higher construction costs for a safer and more comfortable facility.

Sometimes, actions taken to reduce costs may be accomplished by deferring or transferring costs. For example, we can defer costs by requiring less surfacing materials now and more frequent reconstruction later. We can transfer costs by constructing lower standard

roads (for example, steeper grades or rough running surfaces) that raise user costs. Care is taken to ensure that roads are designed to serve the projected traffic requirements at the lowest total transportation costs, (which include construction, maintenance, and user costs), while paying attention to environmental and safety considerations.

#### Operations and Maintenance

The physical condition to which a road is constructed and maintained may determine its use. During 1988, we maintained 55 percent of the road system for use by high-clearance vehicles (such as pickup trucks, 4-wheel drive vehicles, and logging equipment) and 27

percent for use by modern low-clearance passenger cars. The remaining 18 percent were closed to motorized traffic yearlong.

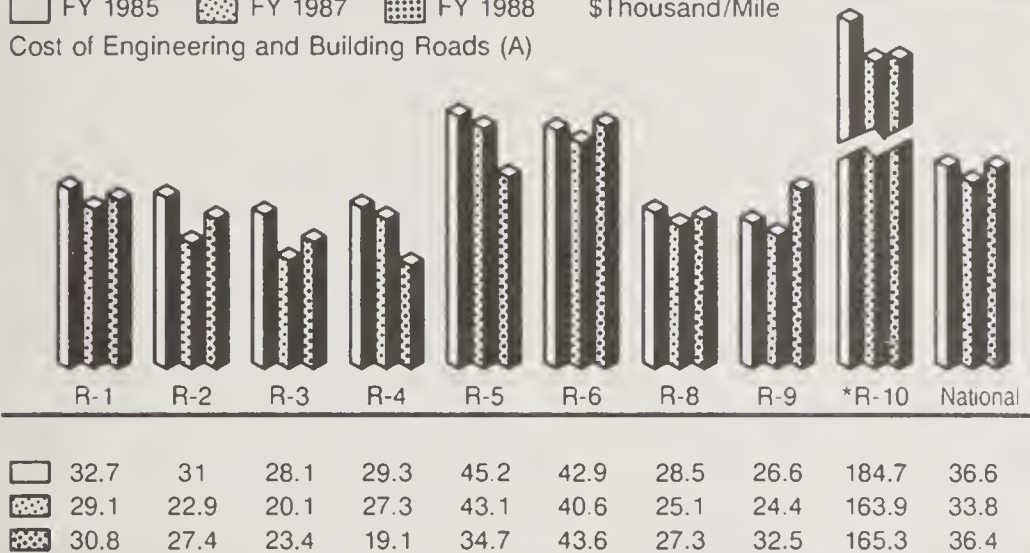
Intensive land use planning revealed that perennial use of many new roads is unnecessary and the percentage of intermittent-use roads is increasing. Intermittent-use roads are generally designed to lower standards than roads open for continuous use, and thus they cost less to construct. In some regions, the roads are seeded to grasses or native vegetation to serve as linear wildlife openings. Improvements in other areas, such as construction and engineering services, also helped reduce costs.



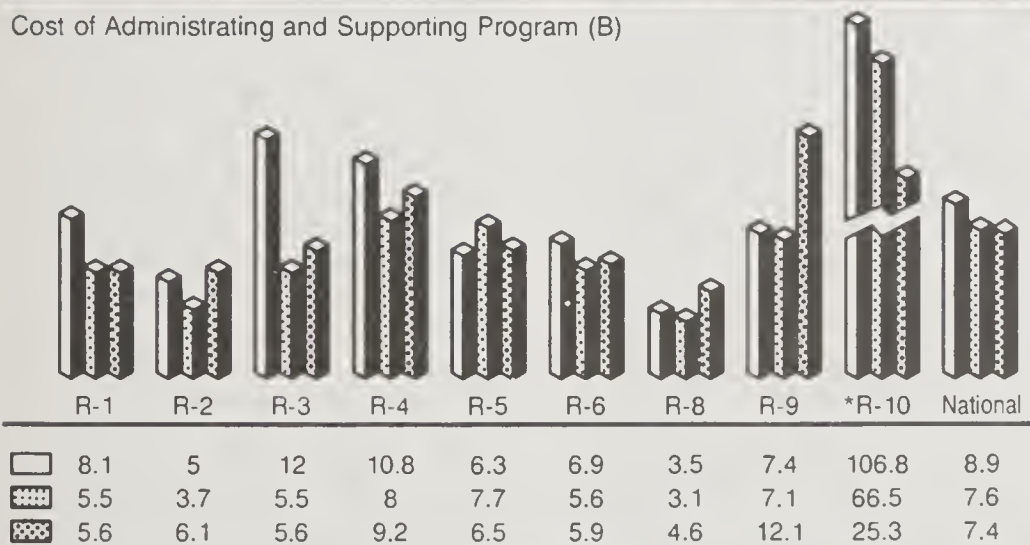
## Summary of Unit Costs for Road Construction and Reconstruction

□ FY 1985    ▨ FY 1987    ▩ FY 1988    \$Thousand/Mile

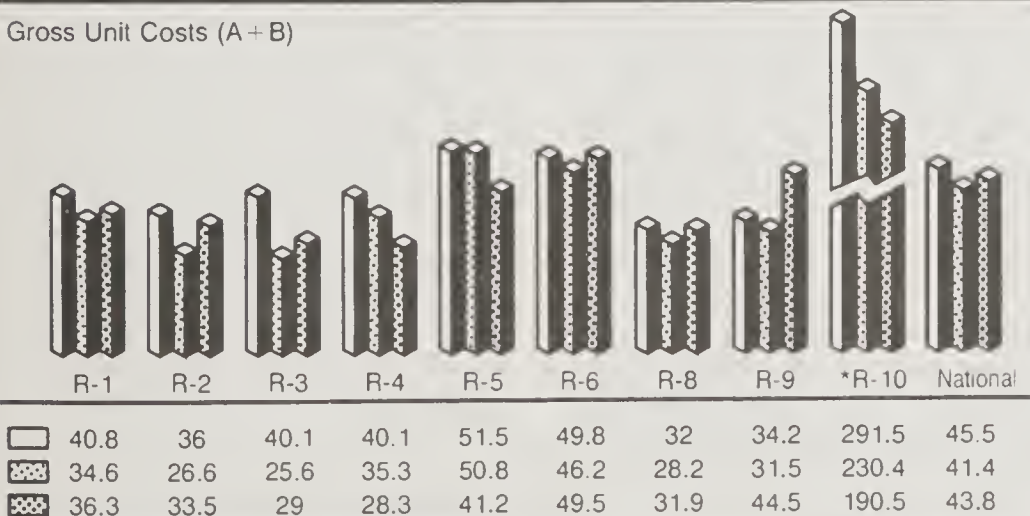
Cost of Engineering and Building Roads (A)



Cost of Adminstrating and Supporting Program (B)



Gross Unit Costs (A + B)



\*Includes Tongass Timber Supply Fund

Seasonal restrictions are implemented when necessary to protect wildlife during migration, mating, or rearing periods; to prevent fires and provide for public safety during periods of high fire danger; to protect road investments during inclement weather and unstable ground conditions; and to provide for public safety during periods of heavy commercial use. During periods of nonuse by normal vehicles, roads are often available for other uses, such as snowmobiling, off-road vehicles, horse-back riding, hiking, and hunting.

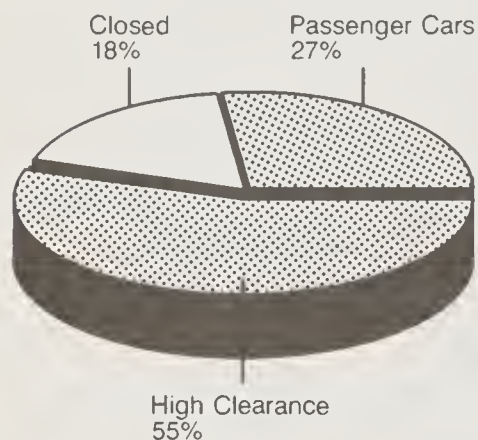
During 1988, the Forest Service used \$77 million in Federal appropriations to perform road maintenance work. This work was in support of Forest Service administrative use and noncommercial forest users. Commercial forest users, such as timber purchasers, miners, and private timber companies, are responsible for road maintenance work related to their commercial activities. The commercial users fulfill their road maintenance responsibilities by actually doing the maintenance work or by depositing funds with the Forest Service to have the work accomplished. An estimate of overall program distribution in 1988 is as follows:

- ▼ Road maintenance with appropriated funds--48 percent (\$77 million).
- ▼ Requirements on federal timber purchaser--48 percent (\$77 million).
- ▼ Requirements on other commercial users-----4 percent (\$6 million).

Total Program  
\$160 million.

The estimated value of the total program, \$160 million, is equivalent to approximately 0.9 percent of the asset value of the total road system, which is estimated to exceed \$18.5 billion. A cost-effective maintenance program for low-volume road systems is estimated to be between 1 and 2 percent of replacement cost. With 1988 funding, about 50 percent of the forest develop-

### Road Management Percent of Total System



ment road system was maintained to a standard adequate to protect investments, environment, and support existing traffic demands. The remaining 50 percent of the road system was maintained at a lower level, and use was limited either by the physical condition of the road or by regulatory restriction.

### Special Management Initiatives

We enhanced information management in 1988 by refining the Road Analysis and Display System (ROADS) and by participating in other resource information and reporting system programs. ROADS provides valuable management tools to analyze and monitor economic efficiency and to control costs associated with the road program. The process helps people outside the Forest Service better understand the road program and provides a systematic approach for tracking the progress toward achieving a more cost-efficient road system.

In 1988, the Forest Service, in cooperation with the American Forestry Association, produced a video taped

panel discussion titled, "The National Forest Roads Controversy." The purpose of the forum was to produce a definitive documentary on the range of issues related to National Forest System land management in general and roads in particular. The panel consisted of representatives from conservation organizations, academia, industry, and the Forest Service.

The video is being used to provide a better understanding of the diverse issues involved with roads required to manage natural resources. A brochure and slide-tape program were also produced to aid forest managers in displaying and providing better understanding of the role roads play in the management of the national forests.

During 1988, we continued to place emphasis on implementing the recommendations of the 1987 Roads Productivity Improvement Team report. These improved activities in planning, cost accounting, engineering support services, road construction, road operation, and road maintenance were effectively used to enhance efficiency and reduce costs.

Through the Coordinated Technology Implementation Program, the Agency worked with other federal agencies to share technology application on such things as pavement management systems, fish culverts, stressed timber bridges, timber guard rails, nonstandard road stabilization treatments, and rock slope stabilization projects.

In 1988, the Forest Service initiated a program to designate scenic stretches of existing roads through or adjacent to national forest land as scenic byways. This program will enhance scenic driving experiences and showcase some of the most beautiful scenery our country has to offer. Currently, 10 such routes have been designated throughout the United States, and more will be selected in a continuing nomination and selection process.

### TECHNOLOGY DEVELOPMENT

As a part of engineering support, the Forest Service has a technology development program. This program is similar to the development side of corporate research and development programs. It complements activities carried out by the Forest Service research program. The purpose of this program is to develop or identify promising new technology and to assist in applying it to land management. Numerous new ideas, methods, systems, materials information, and equipment are brought into use that improve operational efficiencies. The two technology and development centers in Missoula, Montana, and San Dimas, California, are devoted to technology development and applications. Personnel work on 70 to 100 projects in any given year.

### Substitute Earth Anchors

The Forest Service, through its Technology and Development Center at San Dimas, California, has completed development of a substitute earth anchoring system to be used for securing cable logging equipment where naturally occurring anchor points are not available. This system will enable proper placement of logging equipment to harvest timber with the least environmental damage where adequate trees or stumps are not available to anchor the cables and machines. The concept, equipment, and training material were developed in cooperation with manufacturers in partnership with the logging industry. We demonstrated this technology in four locations in 1987 and 1988. Loggers, safety specialists, and resource managers from across the country viewed these demonstrations. Training of Agency logging systems specialists is planned for early 1989. This technology should begin to come into use in the logging industry in 1989.

### Satellite Position Location Systems

The development of satellite-based global positioning systems has progressed to the point where they now



provide an economical method for obtaining the spatial location of resources. The Missoula Technology and Development Center, working with private industry, has identified applications for resource management activities. Through this cooperative effort, light-weight, portable equipment has been developed. In addition, the Center, in cooperation with the University of Montana, has established a national test site at the Lubrecht Experiment Forest for evaluating this equipment. Information gathered from the evaluations at Lubrecht will aid land managers in selecting the proper equipment for the jobs to be performed.

#### Variable Truck Tire Pressures

The development and testing of variable tire pressure technology and the central tire inflation concept continued throughout 1988. Preliminary studies conducted by engineers at San Dimas Technology and Development Center indicate that lowered truck tire pressures in low-speed applications increased vehicle mobility, reduced vehicle operating costs, reduced driver fatigue, and reduced road construction and maintenance costs. This development work has been accomplished with guidance and participation of various tire and truck manufacturing companies, with additional technical support from various industrial associations. Structured tests at the Nevada Automotive Test Center and Southern Forest Experiment Station, and eight demonstration timber sale and road construction projects further support these findings.

We completed the road-surfacing test track at the Waterways Experiment Station in Vicksburg, Mississippi, in cooperation with the Federal Highway Administration and the U.S. Army Corps of Engineers. Testing at the experiment station during 1989 will provide valuable data for future road surfacing designs, road maintenance programs, and on vehicle maintenance.

"Operation Bigfoot," the technology application plan, was approved and pro-

vides the guidelines for further testing, development, and application of variable tire pressure and central tire inflation technology to future timber sales, construction projects, and Forest Service fleet acquisitions.

#### Chunkwood Roads

The technology and development centers continued to investigate the use of chunkwood as a road building material. At many forest road locations, conventional road-building materials are often lacking or are in short supply within an economical transport distance. Chunkwood, a recently introduced form of fist-size wood sheared from whole trees, was investigated as an alternative material for the construction of low-vol-

ume forest roads. In previous years, approximately 2.5 miles of roads were built at 4 different locations on the Chequamegon National Forest in northern Wisconsin.

In addition to the Chequamegon tests, demonstration roads were built on the Kisatchie and Bienville National Forests in the South and the Winema National Forest in the Pacific Northwest. Initial conclusions from field and laboratory tests indicate that chunkwood is a viable alternative as a road building material. Future work on this project will determine the engineering and behavioral characteristics of chunkwood as a substitute for traditional construction materials.



*Chunkwood materials are being tested as a viable replacement for scarce road building materials on low volume roads.* F.S. Photo



### Remote Sensing Training and Special Projects

A continuing national effort in 1988 focused on the development of new training material for aerial photography interpretation by the Nationwide Forestry Applications Program. Several new resource modules were developed, including one for riparian classification, mapping, and monitoring and one for the use of high-altitude infrared color aerial photography for resource assessments in evaluating forest pest impacts.

Two new photograph interpretation training manuals contributed significantly to our ability to deliver high-quality training support: "How to Use Aerial Photographs in Natural Resource Applications" and "Forest Pest Management Photo Interpretation Training Manual." Nearly 400 employees and cooperators received basic or advanced training.

A cooperative project with the National Aeronautics and Space Administration's Ames Research Center High Altitude Aircraft Branch and the Canadian Forestry Service in Alberta sponsored the acquisition of special high-altitude aerial photography and multispectral scanner imagery with the ER-2 reconnaissance aircraft. An evaluation determined the usefulness and cost-effectiveness of the data for issue-specific inventories, such as the distribution and volume of various species of cottonwood in the eastern foothills of the Canadian Rocky Mountains.

Cooperation with the Lake Tahoe Basin Management Unit and the Nevada Tahoe Regional Planning Commission resulted in the successful use of high-altitude infrared color, large-format camera aerial photography to map critical riparian zones surrounding the Tahoe Basin. The information gained is instrumental in formulating guidelines for withholding development in critical riparian zones.

Significant remote sensing technology support was provided to two phases of the fire incident in the Greater Yellowstone Area: (1) near real-time fire detection and mapping with NASA (using ER-2 aircraft for fire control), and (2) satellite imagery and aircraft aerial photography for the fire and during the days after the fire was contained.

### GEOMETRONICS

Geometronics literally means "measuring the earth." Traditionally, it has encompassed the fields of cartography, aerial photography, and photogrammetry. With advances in technology, it now includes automated cartography, digital terrain analysis, remote sensing, orthophotos, and geographic information systems (GIS). These tools are critical for today's land and resource management activities of the Forest Service. The Geometronics program is performed by three organizational entities: the Geometronics Service Center, a production group in Salt Lake City; a unit in each of the nine Regional offices; and a Washington Office branch.

The Geometronics Service Center's primary mission is to produce the Primary Base Series maps and orthophotos for all lands administered by the Forest Service in support of resource management needs. This provides the map base needed by field personnel for the inventory and display of resource and other thematic information. A new program has been initiated to support the implementation of the national GIS plan by providing digital information from the Primary Base Series during the next 5 years. In cooperation with the U.S. Geological Survey and other mapping agencies, the Geometronics Service Center produced 1,416 Primary Base Series maps, 51 Secondary Base Series maps, and 900 orthophotos.

The regional geometronics groups are an integral part of the base series mapping program. They coordinate updates

to the maps and handle printing and distribution. They also directly support the forests' special project needs with surveying, photogrammetric support, data collection, special-purpose maps, and other graphic products.

The branch in Washington deals with national policy and standards and works with other agencies to coordinate programs. The Washington branch also develops computer software and processes. It gives primary support to the digital production processes at the Geometronic Service Center.

### LAW ENFORCEMENT

Forest Service responsibility for law enforcement aims at protecting natural resources, Federal property, employees, and visitors on the national forests. Major law enforcement investigative activities in 1988 covered wildland arson, timber theft, cannabis eradication, internal investigations, theft of artifacts, and destruction of archaeological sites.

The major concern with cannabis production is the risk to national forest visitors, contractors, and employees when they encounter those who are tending or guarding these lucrative crops. Reducing the use of national forests for cannabis production is essential for maintaining a safe environment for all users of the National Forest System. To curb marijuana growth and preserve the safety of forest visitors and employees, the Forest Service implemented special drug enforcement training for many of its law enforcement personnel during 1987 and 1988.

Special agents and law enforcement personnel participated with the Federal Drug Enforcement Administration, the Department of Justice, and State and local law enforcement agencies to detect and eradicate marijuana and to apprehend and prosecute those people who are cultivating it on National Forest



System lands. During 1988, the Forest Service apprehended more than 200 suspects and eradicated more than 250,000 marijuana plants, worth nearly \$500 million at wholesale prices.

The loss of cultural resources from vandalism, digging for artifacts, illegal construction, and theft on National Forest System lands is still of great concern. The Agency has been investigating and prosecuting artifact cases since the mid-1970's. Special agents and law enforcement officers have been directly involved with many convictions in several States under the Archaeological Resources Protection Act.

The purpose of the Cooperative Law Enforcement Program is to compensate local law enforcement agencies for protecting visitors and their property in national forests. Funding has gone to areas where large numbers of visitors must receive their principal protection from relatively small, under-staffed local law enforcement agencies. Wherever law enforcement presence has increased, criminal acts to visitors and their property have decreased.



*A Forest Service Law Enforcement Officer removes cannabis illegally grown on one of the national forests.* Photo by Wilma Marine



Photo by Ken Hammond



# *State & Private Forestry*





## INTRODUCTION

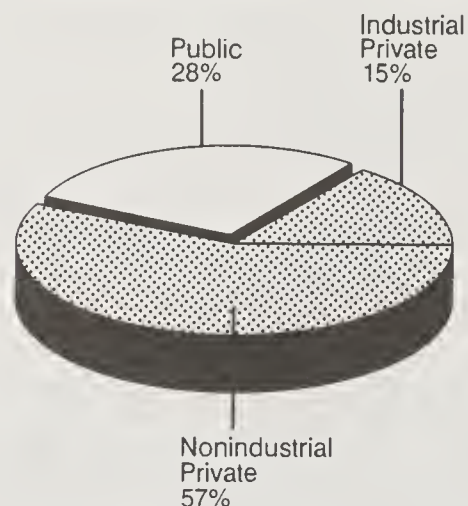
To meet the Nation's needs from its forested and associated range and watershed lands, the planning, management, and protection of those lands must be coordinated among all ownerships. State and Private Forestry (S&PF) reaches across ownership and organizational boundaries to promote the wise use of our natural resources today and to plan for continued wise use by future generations.

The Forest Service serves as the link between many public and private organizations and provides leadership to protect and enhance the Nation's forests. State and Private Forestry provides protection from fires and forest pests on National Forest System lands and technical and financial assistance to help manage and protect other public and private lands.

The demand for forest products is projected to rise 47 percent between the years 1986 and 2040. S&PF programs are specifically aimed at meeting the critical need for increased productivity on private forest lands. Of the Nation's timberlands, 72 percent are privately owned--15 percent by industry and 57 percent by private nonindustrial landowners. Under the Cooperative Forestry Assistance Act of 1978, State and Private Forestry programs provide technical and financial assistance to State forestry organizations, which in turn assist private forest landowners. This assistance includes nationwide studies and analyses on forest management and protection issues that affect all landownerships. Accomplishments on private lands reported in this chapter are funded by a combination of Federal, State and private dollars.

S&PF has the primary responsibility for Agency leadership in transferring knowledge and technology inside and outside of the Forest Service to improve forest resource management, utilization, and protection. The Forest Service helps transfer and apply forestry research

### Timber Lands by Ownership



results throughout the forestry community. We also help find new technologies and knowledge needed by individuals, academia, and Federal and non-Federal organizations. Technology transfer methods include symposiums, training, technical assistance, demonstration projects, formal technology transfer agreements, and the exchange of employees, publications, and consultations.

S&PF takes the lead for the Forest Service on emerging national forestry issues that affect all program areas, regardless of land ownership. In 1988, the following were emphasized:

- ▼ **Forest Health.** Healthy, productive forests are essential to the prosperity of the Nation and the well-being of its citizens. This year, S&PF led an effort involving the Forest Service and other groups to publish and begin implementing a strategic plan to improve the overall health of the forests.
- ▼ **Wildland/Urban Interface.** The effect of urban encroachment into adjacent wildland areas is creating new problems in all aspects of natural resource management and protec-

tion. More people with urban perspectives and values for land use are living in these areas. In this growing "wildland/urban interface," problems are being identified, and needs for new technology in forest management, forest health, and fire protection are being recognized.

- ▼ **Rural Development.** Forest resource management efforts help diversify rural economies and support efforts to revitalize rural development activities. We work through State forestry agencies and with others at State and local levels to promote natural resource management as a key part of each State's rural development planning.

This chapter discusses State and Private Forestry program accomplishments in the following four categories:

- ▼ **Fire and Aviation Management.** This program includes fire prevention, fuels management, and fire suppression. In fire prevention programs, a public awareness of the destructiveness of wildfires is emphasized. Fuels management reduces the volume of hazardous forest and rangeland fuels to lessen the potential for large destructive wildfires. Coordinated fire suppression efforts employ the resources of many government and private organizations to combat wildfires on the forest lands of the Nation.
- ▼ **Forest Pest Management.** This program assists land managers in protecting forest resources from insects and diseases, with emphasis on integrated pest management. It includes detection and evaluation of pest populations and damage, and advice to managers about prevention and suppression needs and options to reduce damage caused by insects and diseases.
- ▼ **Forest Management and Utilization.** Technical advice is provided to private landowners for

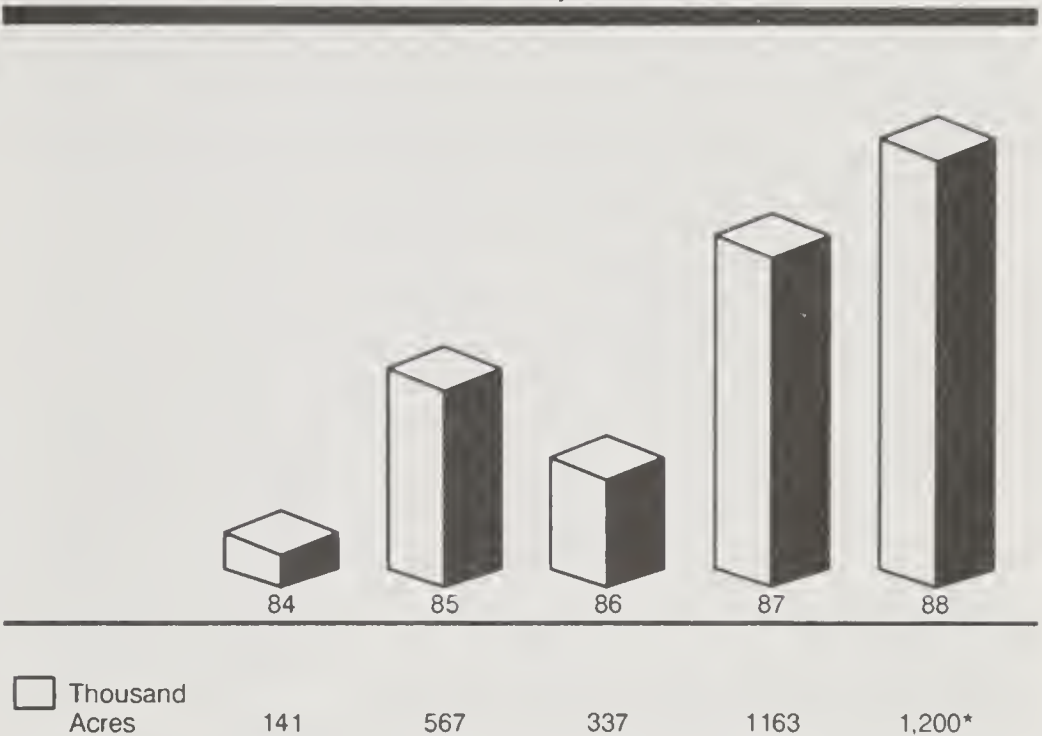


improving the productivity of their forest lands through the following programs:

- Forest management
- Utilization and marketing
- Seedlings, nursery and tree improvement
- Urban and community forestry
- Forestry incentives
- Statewide forest resources planning
- Cooperative watershed activities
- Resource conservation and development

▼ **Special Projects.** Congress has assigned S&PF responsibility for administering forestry-related special projects that require Federal-State cooperation because of our close partnerships with State governments.

### Acres Burned Under National Forest System Protection



\*Preliminary figure.

## FIRE AND AVIATION MANAGEMENT

### 1988 Fire Season

The 1988 fire season was a continuation of the severe fire activity that began in August, 1987. Drought conditions for the third consecutive year created extremely high fire potential throughout the western United States. A total of 72,750 wildfires burned over 5 million acres. Approximately 1.2 million of these acres were on National Forest System lands. The Forest Service played a major role in suppressing fires on other Federal and State lands, including the Greater Yellowstone Area, as well as on National Forest System lands.

### 1988 Fire Season Statistics--Resources, Costs, and Damage

During 1988, more than 41,000 fire personnel were mobilized, including:

- ▼ Crews from 39 States and Canada
- ▼ 5,600 military personnel trained and mobilized

- ▼ 4,000 emergency firefighters trained and mobilized

The costs associated with 1988 fires included:

- ▼ Forest Service expenditures of \$413 million
- ▼ Emergency rehabilitation estimated at \$6 million

The damage from these fires included:

- ▼ More than 11,000 fires on National Forest System lands
- ▼ Natural resource losses estimated at \$65 to \$70 million

### Fire Suppression Policy

Forest Service fire suppression policy is to suppress all wildfires in a timely, energetic, and thorough manner, with a high regard for public and firefighter safety. This suppression policy is applied in both wilderness and nonwilderness areas. However, different suppression

responses may be applied in wilderness areas based on differing values, constraints, and management objectives for these lands.

In the 1988 fire season, 90 percent of all fire starts on National Forest System lands were effectively suppressed at less than 10 acres (minimal resource value loss) as the direct result of available fire protection.

### Fire Readiness

Light snowpack and sparse rainfall during the winter months of 1987 set the stage for an early spring fire season in 1988. The Palmer Drought Index helps forecast fire season severity based on fuel moisture content. As shown on the Palmer Drought Severity maps, drought conditions were more severe and more widespread in 1988 than they had been in 1987. Due to the continued drought over the past several years, fuel moisture content reached an almost unheard of low in 1988. Early recognition of drought conditions and the potential



*A glow lingers moments after fire raced through.* F.S. Photo

effect on fire starts and fire behavior prompted extraordinary preparation for the anticipated fire activity. Fire managers activated initial attack crews 2 months earlier than normal, support military units were trained well in advance of need, and fire retardant and other support aircraft were positioned in areas where the probability of fire occurrence was high.

The Forest Service implemented action plans in 1988 that were developed from regional and national reviews of the 1987 fire season performance. Increased monitoring and analysis of fire weather aided in identifying problem areas. During March, early fire activity brought on by drought conditions resulted in an emergency declaration by the Federal Emergency Management Agency, allowing special Federal funding for fire problems.

### Greater Yellowstone Area Fires

A combination of drought conditions, natural fuels buildup, and timber mortality caused by insects produced one of the most intensive fire situations in recent times in the Greater Yellowstone Area. These conditions led to extreme fire behavior; that is, fires spread at high rates, new fires were started by embers carried by the wind, fuels were completely consumed, and several communities were threatened.

The Forest Service played a major role in managing and suppressing eight major fires that encompassed more than 1.1 million acres inside Yellowstone National Park. In addition, we were responsible for managing and suppressing fires that burned 564,000 acres of national forest wilderness areas and 2,600 acres of nonwilderness just outside the national park boundary.

All the regularly available Federal and State resources were rapidly committed to the firefighting effort. These forces were supplemented by 5,600 military personnel, eight C-130's equipped with Modular Airborne Firefighting Systems, 55 helicopters, and two military infrared aircraft. In addition, 4,000 emergency firefighters were hired and trained to supplement existing firefighting personnel.

The fire suppression effort in the Greater Yellowstone Area was a cooperative effort involving the Forest Service, the National Park Service, the Bureau of Land Management, the Fish and Wildlife Service, the Bureau of Indian Affairs, many States, the U.S. Army, the Marine Corps, the National Guard, Canada, and numerous rural and volunteer fire departments.

Severe fire activity, as experienced this year, clearly demonstrates the effectiveness of multi-agency cooperation and assistance in fire protection. No single agency can afford to maintain a protection organization of sufficient strength to handle above-normal fire conditions.

### Rehabilitation

Rehabilitation efforts began even before the fires were declared "controlled." Initial emergency rehabilitation cost estimates have reached over \$6 million. Over 78,000 acres were seeded with rapid-growing grasses to provide protective cover. Erosion control structures and road and trail erosion control methods were applied in key areas. Special emphasis was given to protecting downstream communities from flooding and sediment, protecting the quality of municipal water supplies, and protecting the long-term productivity of forests and rangelands.

### Cooperation with Canada

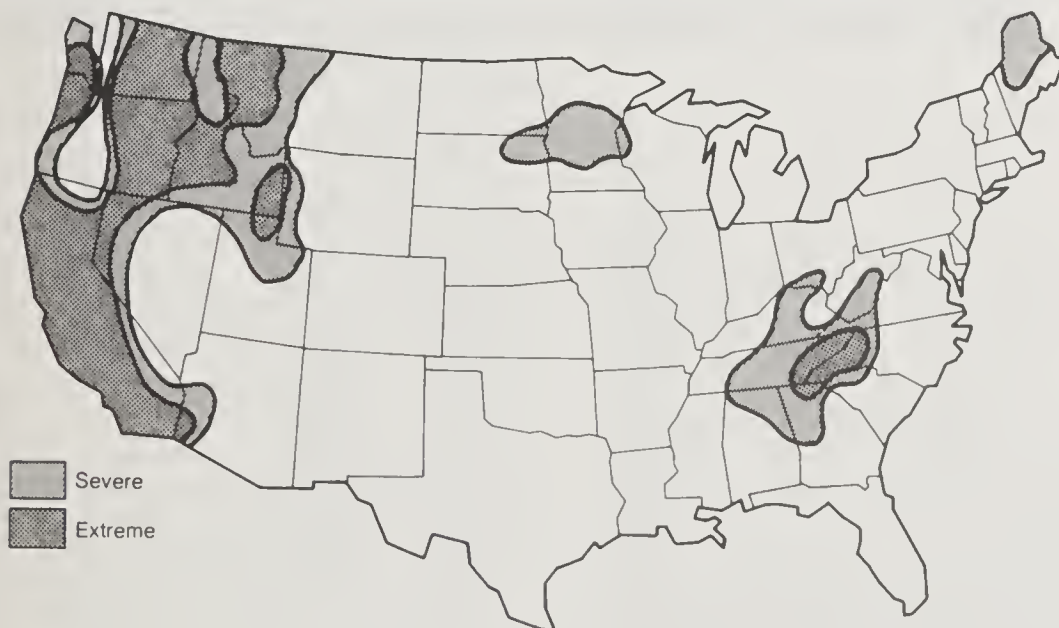
Canada also experienced one of its worst fire seasons and, in March, requested assistance from the United States. The Forest Service provided



### Palmer Drought Severity April 1987



### Palmer Drought Severity April 1988



nine crews, one National Incident Management Team, and equipment to support Canadian firefighting activities. In September, as fire activity in the United States continued, emergency legislation enabled Canada to reciprocate by supplying crews, support personnel, airtankers, infrared systems, and other equipment to us.

#### Hotline

The Forest Service established a season-long Fire Information Center and Hotline to handle the demand for information about the western fires. More than 1,000 inquiries from national television networks, wire services, newspapers, and magazines were handled.

#### Fire Prevention

Throughout 1988, fire prevention efforts continued to educate the public about ways they can help prevent wildfires. "Smokey and the Pro's," a national effort to deliver our fire prevention message in cooperation with major league sports, was expanded to include college, high school, and little league levels. Smokey delivered the fire prevention message to over 1 million fans in attendance at major league baseball games.

A major prevention problem exists in the interface between wildland and urban areas. In the South, during a 20 day period, 15,300 fires burned 577 of the 28,300 structures that were threatened. During this period, four people lost their lives, and three were seriously injured.

To deal with this problem, the National Wildland/Urban Fire Protection Initiative was launched in 1986. This is a cooperative program among the Forest Service, the Department of the Interior, the Federal Emergency Management Agency, the National Association of State Foresters, and the National Fire Protection Association. This year, numerous workshops, media field trips, home owner safety guide publications, satellite broadcasts, and videos covering the spectrum of wildland/urban fire protection issues were made available to increase public awareness of the problem and to promote preventative measures.

#### Fuels Management

An aggressive fuels management program can greatly reduce damage from wildfires by reducing fire intensity and the rate of fire spread. Fuels accumulate through both management activities (activity fuels) and natural processes (natural fuels). As part of the fuel management activities on national forest land, 347,130 acres of natural fuels were treated.

Two examples from the Pacific Northwest demonstrate the benefits of fuels treatment. At the Shady Beach



*Heavy smoke columns from the North Fork Fire set an ominous backdrop to the community of West Yellowstone, Montana.*

F.S. Photo



*A helicopter lifts seeds to sites burned by the Canyon Creek Fire. The rehabilitation will help prevent erosion.*

Photo by Karen Westly

*Canadian air tanker drops retardant.*

Photo by Don Seabrook



and Falls Creek fires, the initial spread of the fire resulted from high winds carrying embers into privately owned lands where fuels had been left untreated. The fires then spread into surrounding areas of old-growth timber. Control was only possible along major ridges and in areas where fuels had previously been treated.

### International Fire Management

This year, the Forest Service continued to be a leader in fire management at home and abroad. International cooperation provides insight into our own programs and valuable training to countries with less developed fire protection technology.

Forest Service participation in the North American Forestry Commission, a cooperative effort involving Canada, Mexico, and the United States, has helped promote cooperation across international boundaries. At the request of the World Bank, we helped develop fire protection projects in China. We provided expertise to Argentina and parts of Africa, Israel, Indonesia, and Mexico to develop their fire protection and training programs. We also provided expertise for a major locust spray project in North Africa. We hosted six study tours for representatives from Israel, Chile, India, Turkey, Argentina, and Mongolia.

### Rural Fire Prevention and Control

Rural Fire Prevention and Control (RFPC) is the primary Forest Service program that facilitates cooperation and sharing of firefighting resources and expertise between States and Federal agencies. This program provides technical assistance to all States to enable the rapid dissemination of new equipment and techniques to better respond to fire emergencies. In addition, RFPC funds are used to train and equip State personnel, enabling their effective use on large fires across the Nation.

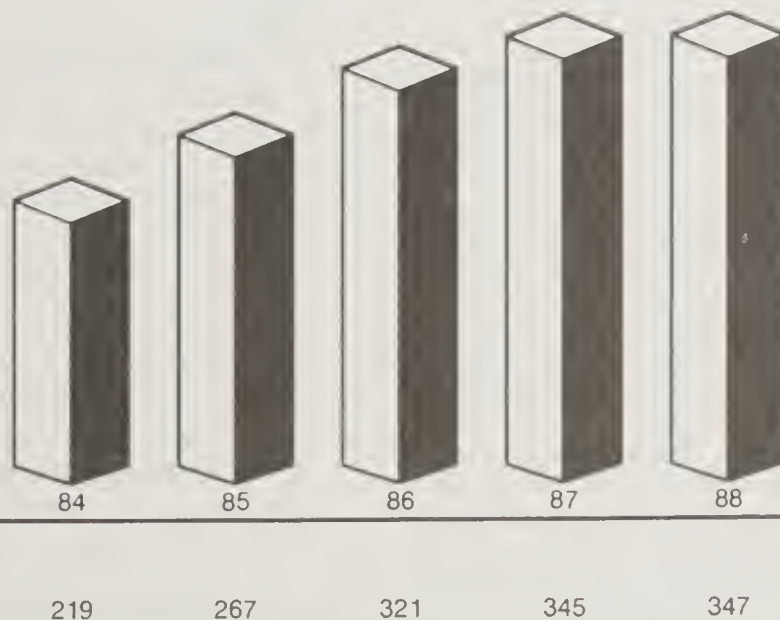
A major focus of the program is to strengthen relationships with the States by involving them more in the identifica





*Log barn burns near Polebridge, Montana as the Red Bench Fire advances.*  
Photo by Larry Humphrey, BLM

#### Acres of Fuels Treatment Accomplished - National Forest System Lands



tion, development, and implementation of new cooperative efforts. A significant example took place in the Northeastern Region, where 26 crews were trained and mobilized by State personnel to

support the suppression efforts in the West. Our cooperative programs play a major role in supporting the States, which in turn provide support to national forest fire protection and suppression.

A funded component of RFPC is the Federal Excess Personal Property program, which played an important part in this year's fire suppression activities by providing the mechanism and network for loaning excess Federal equipment to State Foresters who subsequently refit it into firefighting equipment. In 1988, more than \$38 million in equipment was loaned. This program facilitates use of the equipment, reduces overall program costs, and improves relationships with States. Currently, our fleet of equipment on loan to State Foresters is valued at more than \$320 million.

#### Rural Community Fire Protection

The Farmers Home Administration funds this program, and the Forest Service administers it. The program provides technical and financial assistance to train, organize, and equip rural fire departments. This assistance is intended for small communities, under 10,000 in population, so that they can provide a basic level of fire protection. These rural areas conduct numerous fund-raising activities to generate matching funds for the purchase of firefighting equipment. The training provided to these small, often volunteer, organizations paid large dividends this year, enabling many volunteer fire departments to dispatch engines to the western fires. This program enables local fire departments to assume responsibility for local fires on private lands, reducing the reliance on Federal resources.

#### FOREST PEST MANAGEMENT

The direct benefits of timber values saved by pest management prevention and suppression project activities on all lands are estimated at \$98 million for 1988. Resource projects also help protect watersheds, wildlife habitats, and recreation values.

Nationwide, program expenditures totalled \$56 million--\$44 million in Federal funds and \$12 million in cooperative funds. Federal funds supported all



An entomologist on the Mount Hood National Forest examines spruce budworm larvae to determine insect development in an area scheduled for treatment. Photo by Bill Ciesla

program and suppression activities on Federal lands, plus 29 percent of program activities and 43 percent of suppression activities on State and private lands. Cooperative funds supported the balance of cooperative program and suppression activities.

### Survey and Technical Assistance

Surveys are an essential first step to protecting the forest resources from damage and losses caused by pests. The Forest Service conducted aerial and ground surveys to detect and evaluate vegetation damage or pest populations on 105 million acres of National Forest System lands and 28 million acres of other Federal lands. With Forest Service assistance, State forestry organizations conducted similar surveys on 460 million acres of State and private lands. RPA targets for the Low Bound are 170 million acres and 466 million acres for the High Bound. Managers of affected lands were given

the results of the surveys, along with recommendations and advice about what suppression alternatives were needed.

Forest Service pest management specialists provided technical assistance to National Forest System and other Federal land managers and to State pest management specialists through consultation, seminars, workshops, publications, and reports. Assistance topics ranged from pest identification and survey techniques to pesticide selection and application. The Forest Service trained 305 Federal personnel in the proper handling, application, storage, and disposal of pesticides.

### Prevention and Suppression

Pest suppression projects protected an estimated 1,126 million cubic feet of merchantable timber. In addition, an estimated 41 million cubic feet of infested timber was salvaged.

Gypsy moth suppression projects were conducted on 17,900 acres of National Forest System lands in 2 States and on 9,400 acres of other Federal lands in 5 States. Projects were also conducted on 719,300 acres of State and private lands in 9 States. This is an increase of 53,300 acres over the 693,300 acres treated in 1987.

The Forest Service contributed to gypsy moth eradication projects on 31,400 acres of National Forest System lands in North Carolina and Virginia. This compares to 5,100 acres in 1987. Of the 778,000 acres treated, 37 percent were with *Bacillus thuringiensis* (Bt), a bacterial insecticide, and 63 percent with Dimilin, an insect-growth regulator.

Southern pine beetle suppression was conducted on approximately 3,900 acres of National Forest System lands in 8 States, 60 acres of other Federal lands in 2 States, and 2,000 acres of State and private lands in 2 States. Suppression activities protected about 103 million cubic feet and salvaged an additional 40 million cubic feet of pine timber.

Western spruce budworm suppression projects in Oregon protected about 129 million cubic feet of merchantable timber. About 409,300 acres of national forest, 125,000 acres of other Federal, and 64,100 acres of State and private lands were protected with Bt.

Mountain pine beetle suppression occurred on 900 acres of National Forest System lands and 22,000 acres of State and private lands. About 5 million cubic feet of timber was protected, and an additional 1 million cubic feet of timber was removed.

### Pest Management Special Projects

The Appalachian Gypsy Moth Integrated Pest Management Demonstration Project is a multiyear project designed to show that the spread of gypsy moths can be slowed and the negative effects reduced in areas where the gypsy moth is present. In 1988, the first round of



field tests in the project was completed. The results will be evaluated during the winter of 1988-89. Tests were conducted to control low-level populations using viral and bacterial insecticides, an insect growth regulator, and a gypsy moth sex attractant.

### Forest Health--A Strategic Plan

The Forest Service developed and started the implementation of a plan to enhance and maintain the health of the Nation's forests. The Forest Service will demonstrate the effectiveness and efficiency of selected actions. We expect that strategies successful on National Forest System lands will apply to other forest land ownerships. This plan responds to concerns about the health of the Nation's forests expressed by Members of Congress during the appropriation hearings on the 1988 Forest Service budget.

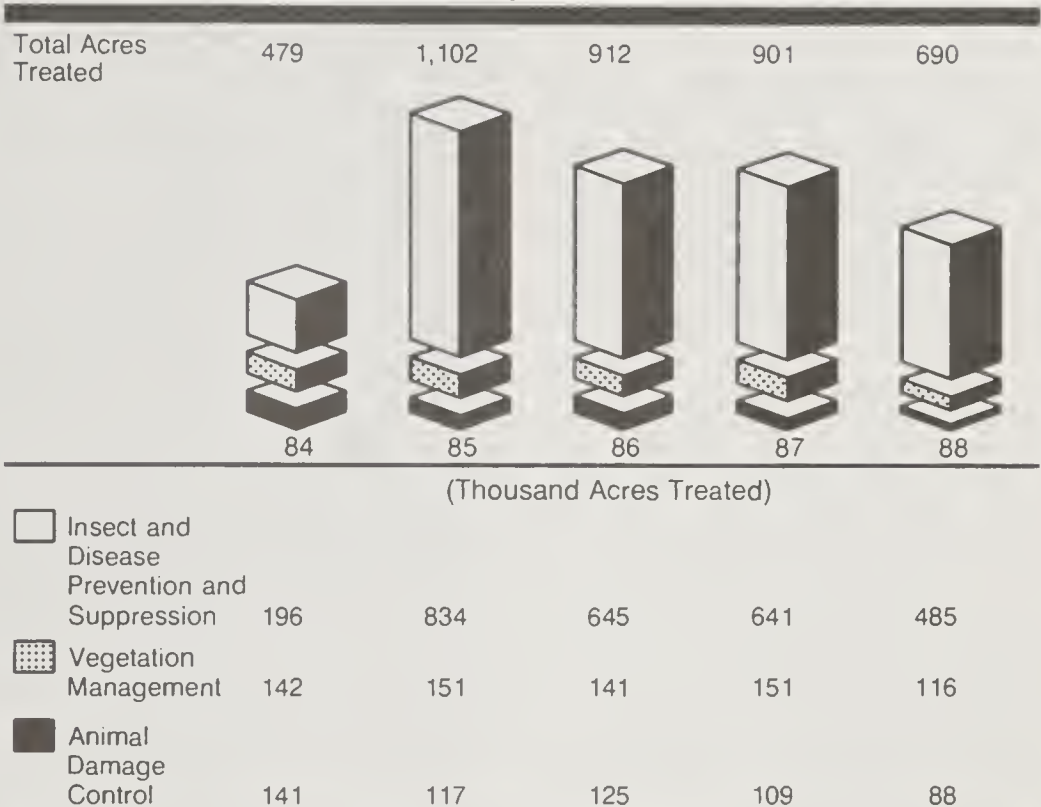
The Forest Service continued its participation in the National Agricultural Pesticide Impact Assessment Program. In 1988, there were 17 projects designed to improve our knowledge of the benefits and risks of using pesticides in forestry. Most studies concentrated on the exposure of workers to pesticides or on the fate of pesticides in the environment.

### Pesticide Use

In 1988, we treated approximately 689,607 acres of National Forest System lands with pesticides, including 485,488 acres for insect and disease prevention and suppression, 116,346 acres for vegetation management, and 87,774 acres for animal control and other minor uses (table 44). Pesticides were applied on less than 1 percent of the total acreage of the national forests and grasslands.

Pesticides are one component of an integrated approach to pest management. They prevent and suppress insect and disease outbreaks, reduce unwanted vegetation, and control ani-

### Pesticide Use on National Forest System Lands



Numbers may not add due to rounding.

mals that cause damage. Pesticides are prescribed only after thorough environmental analyses determine that their use is appropriate. The Forest Service only uses pesticides registered by the Environmental Protection Agency.

## FOREST MANAGEMENT AND UTILIZATION

### Forest Management

The Forest Management program, in cooperation with State forestry agencies, provides technical assistance to nonindustrial forest landowners to enable them to manage their forest lands. During 1988, this program helped landowners plan the management of 4 million acres, plant trees on 1.4 million acres, and improve the stand productivity on 260,000 acres of private forest land.

### Utilization and Marketing

In 1988, \$1 million was appropriated for the Utilization and Marketing program. These funds provided technical assistance to help timber-dependent communities improve their economic conditions by strengthening the competitiveness of the forest products industry in their communities. One specific program accomplishment was the development of a computerized Forest Industry Data (FIND) national reporting system, in cooperation with the Tennessee Valley Authority and several State agencies. This system will make State forest industry directories and other published data more uniform, easier to update, and more usable for potential investors and buyers. Seventeen States have already adopted the system.

Another system developed in 1988 is the Integrated Mill Production and

Recovery Options for Value and Efficiency (IMPROVE) system, which provides a format by which several successful recovery improvement programs, containing the latest in technology and research, are integrated into a package of data collection procedures and computer software. The system will provide industry with more effective tools for improving efficiency in converting commercial lumber into consumer goods.

In cooperation with the States, S&PF sponsored conferences to transfer timber bridge technology. Nearly 400 State and local government officials, consulting engineers, and others attended these conferences and were successful in implementing this technology. For example, as a result of the 1987 conference in Pennsylvania, the Township of Milford built 5 wood bridges in 1988, saving \$400,000 from the estimated cost of comparable bridges built with more expensive materials.

Congress agreed to fund a trial Marketing Initiative program with \$1 million for 1988. These dollars supported 50 specific projects that are aimed at improving domestic and export markets for wood products. Cost-sharing of marketing projects by local sponsors more than doubled the leverage of Federal expenditures and helped the program focus on high priority areas. The following are two examples of the approved projects under this program:

- ▼ A Pennsylvania project developed design values for 7 hardwood species groups and obtained certification of the values by the American Lumber Standards Committee of the Department of Commerce. Completion of this project opened the door for using hardwoods in the construction of timber bridges, timber frame homes, and similar structures. These market opportunities for structural uses of hardwoods exceed 1 billion board feet per year, a 10 percent increase over current hardwood production levels.



*New technology is demonstrated by this stressed timber bridge designed by the Forest Service and built as part of a timber bridge conference at Penn State University.*

Photo by Clyde Weller

- ▼ An export development project called "Washington Village" is being co-sponsored by several States in the West and wood products associations. The objective is to erect an entire village in Kobe, Japan, using construction techniques traditionally used in the United States. This will promote the use of U.S. home designs and wood products in the Japanese home building industry.

#### **Seedlings, Nursery, and Tree Improvement**

The objective of this cooperative Federal-State program is to upgrade the quality of nursery operations and improve the productivity and quality of non-Federal forests. The program achieves this objective by increasing seedling survival, shortening rotations, improving species resistance to disease and insects, and improving tree form and wood quality.

In 1988, 2.5 billion tree seedlings were produced and planted on approximately 3.4 million acres in the United States.

Almost 90 percent of these seedlings were planted on private lands, primarily in the South. The Conservation Reserve Program (CRP), established as part of the Food Security Act of 1985, continues to increase tree-planting efforts.

With S&PF assistance, this year State nurseries prepared for another record planting year in 1989. In 1988, the 88 State forest nurseries, previously developed with Federal and State funds, produced about 36 percent of the total seedling production in the United States and were the primary source of tree seedlings for nonindustrial forest landowners.

The 1988 drought caused significant losses in young forest plantations. Replanting these areas will place additional demands on State and private nursery programs. Demands also increased because of the use of tree planting as a strategy to combat global warming caused by the greenhouse effect.





*Tree lifting time at the Ashe Nursey on the DeSoto National Forest in Mississippi.*  
Photo by Barry Nehr

### Forestry Incentives

The Forestry Incentives Program (FIP) and the forestry portion of the Agricultural Conservation Program (ACP) provide financial incentives to owners of nonindustrial private forest lands for reforestation and timber stand improvement. The Agricultural Stabilization and Conservation Service (ASCS) transfers funds for the technical

assistance aspects of these programs to the Forest Service.

FIP and ACP account for much of the reforestation on nonindustrial private forest lands and are important in meeting national wood supply needs. In 1988, FIP resulted in an estimated 151,398 acres receiving treatment. During the same period, ACP treated an estimated 126,050 acres. These treated acres

included 121,239 acres of reforestation for FIP and 98,136 acres for ACP.

The Conservation Reserve was established under the 1985 Food Security Act to remove highly erodible cropland from production. Congress established a goal of 12.5 percent tree planting out of a total goal of 40 to 45 million acres of land in the Reserve. In 1988, approximately 623,000 acres were enrolled for tree planting. To date, after seven signups, tree plantings total about 1.8 million acres or about 6.3 percent of the total 28.6 million acres enrolled in the program.

### Urban and Community Forestry Assistance

The Urban and Community Forestry program promotes improvement in community quality of life through the planting and management of trees, shrubs, and other vegetation. These efforts improve the environment and make major contributions to soil, water, and air quality. In 1988, financial assistance to States was approximately \$1.3 million for urban and community forestry activities. State Foresters used these funds to provide technical assistance to more than 6,000 projects in communities whose populations totaled over 30 million people. Joint Federal and State program accomplishments in 1988 included the following:

- ▼ With S&PF assistance, the American Forestry Association, through the National Urban Forest Council, continued to publish "how to" articles in "American Forest" magazine and the "Forum Newsletter." Circulation exceeded 40,000 for both publications in 1988.
- ▼ With assistance from the Forest Service, the National Association of State Foresters developed an urban forestry assessment to determine the state of the Nation's urban forests. The assessment resulted in the development and implementation of a national management plan for





*Field reviews of Conservation Reserve tree planting ensure quality control—proper care, handling, and planting of seedlings. Results from these reviews increase seedling survival; decreasing program costs. Team members establish a 1/100th acre plot in which trees will be sampled to evaluate quality control.* F.S. Photo

urban forestry that will be implemented at the State and local level.

- ▼ The Forest Service continued its outreach efforts in the minority community by displaying forestry exhibits and participating in meetings of organizations representing over 12 million people.

### Statewide Forest Resources Planning

The Forest Service provides assistance to State Foresters to develop statewide Forest Resource Plans. These plans provide a framework for the States to evaluate alternatives to meet future resource needs. This program received \$850,000 in 1988. This money, in combination with State dollars, sponsored seminars, workshops, publications, and planning positions in the States. Most States are implementing or updating existing plans. As a result of these plans, State governments are focusing more on good management and stewardship of forest resources to promote economic development.

### Taxation

S&PF provides taxation assistance information to forest landowners. The major accomplishment in taxation assistance in 1988 was the revision and updating of the publication, "A Guide to Federal Income Tax for Timber Owners." All work scheduled under a taxation technology transfer program for the southeastern States has been completed. Forest Service tax coordinators wrote several articles for forestry-oriented magazines and conducted or participated in numerous forest taxation meetings. A one-page publication, "Tax Tips for Forestry Landowners," was developed for use by forest landowners in the Southeast.

### Cooperative Watershed Activities

The Forest Service is responsible for the forestry aspects of the studies and planning projects conducted by the Soil Conservation Service (SCS) for the Small Watershed (Public Law 83-566), Flood Prevention (Public Law 78-534),

and Emergency Watershed Protection (Public Law 95-334) programs.

In 1988, S&PF participated in 49 river basin studies and 63 watershed planning projects conducted by the SCS. Forest land stabilization treatment measures were installed on 70 small watershed projects. Funds from these programs paid for land stabilization practices on critically eroding areas and helped State Foresters provide technical assistance with forestry practices.

Funds transferred to the Forest Service from the Soil Conservation Service were also used for forestry measures on five flood prevention watersheds. Primary activities included accelerated fire prevention activities on the Los Angeles and Santa Ynez watersheds in California, gully stabilization on the Trinity River in Texas and the Washita River in Oklahoma, and landowner assistance on the Potomac River in Virginia, Maryland, and West Virginia. In West Virginia, the funds were used by State forestry personnel to assist landowners in road location and non-point pollution control.

Rehabilitation of western burned areas dominated the Emergency Watershed Program in 1988. S&PF coordinated the seeding of private lands with similar efforts on national forest lands. Projects were completed in California, Utah, Nevada, and Idaho. A total of 15,351 acres of private land burned by 7 fires were seeded. The Emigration Canyon fire in Utah is an example of this work. This 5,600 acre fire burned much of a key Salt Lake City water supply watershed. S&PF arranged for 2,000 acres of private land along with public land to be aerial seeded under a contract administered by the Wasatch-Cache National Forest.

S&PF continued cooperation with the Office of Surface Mining in planning and conducting mine reclamation courses, which covered soils, hydrology, and management. During 1988, 219





*A West Virginia Forestry Division Forester discusses the proper installation of waterbars to enhance proper road drainage for this private landowner. Photo by Barry Nehr*

trainees, primarily State and Federal regulatory personnel, took part in the 19 courses that were offered.

### **Resource Conservation and Development**

The Forest Service is responsible for the forestry provisions of the Resource Conservation and Development Program, which is administered by the Soil Conservation Service. In 1988, funds allocated to the Forest Service totaled \$786,000 for 54 of the authorized 189 project areas throughout the United States. The funds were 80/20 cost-shared with 32 State forestry organizations. Forestry technical assistance was provided to local sponsors who contributed to improved economic, social, and environmental conditions in rural resource conservation and development areas.

Accomplishments included training courses for sawmill operators and secondary processors in Pennsylvania, establishment of a forest resource data base to attract forest industry in New York, studies for conversion to wood energy in Alabama, hardwood manage-

ment and marketing assistance for landowners in California, harvesting and marketing information for Christmas tree growers in Arizona, and promotion and development of the pine straw industry in Georgia.

## **SPECIAL PROJECTS**

### **Boundary Waters Canoe Area**

The Forest Service cooperates with the State of Minnesota, under the authority of the Boundary Waters Canoe Area Wilderness Act of 1978, to intensify forest management on forest lands owned by the State, its counties, and private citizens. The purpose is to mitigate the loss of timber production caused by incorporating forest lands into the Boundary Waters Canoe Area Wilderness.

Minnesota uses approximately \$3 million of Federally appropriated money annually and adds about \$750,000 of State funding each year. Intensified activities in 1988 included 31,880 acres of reforestation, nursery production of nearly 22 million seedlings, develop-

ment of management prescriptions on 12,000 acres, and improvement of more than 1,700 miles of forest access roads.

The program has successfully met its stated objectives. Lands of all ownerships are being improved. The State has developed excellent inventory data to identify opportunities for industrial expansion. The forest industries are responding by planning new facilities and improvements to existing plants. The road improvements are being planned to minimize impacts, yet maximize economic opportunities to improve the forest land productivity.

### **Burton-Santini Act**

The Burton-Santini Act (Public Law 96-586) authorizes the Secretary of Agriculture to make financial assistance grants to local governments within the Lake Tahoe Basin for the purpose of reducing soil erosion and water pollution. The Lake Tahoe Basin Management Unit works cooperatively with Placer and El Dorado Counties, California, the City of South Lake Tahoe, California, and Douglas and Washoe Counties, Nevada, in selecting projects.

In 1988, local governments were awarded \$1.3 million for new projects. Local sources matched Federal funds with \$8.5 million. The share of the work funded by local sources is the highest to date.

### **The Pinchot Institute for Conservation Studies**

The Pinchot Institute for Conservation Studies is a special unit of the Forest Service located at Grey Towers National Historic Landmark in Milford, Pennsylvania. Its purpose is to examine and address emerging conservation issues. Grey Towers was the ancestral home of Gifford Pinchot, pioneer conservationist and first Chief of the Forest Service. State and Private Forestry administers the Pinchot Institute, with funding provided by benefitting Forest Service appropriations.

This past year, approximately 900 interpretive house and garden tours were conducted for over 12,000 visitors.

Mansion and landscape restoration projects continued with funding contributed by the National Friends of Grey Towers.

Grey Towers also served as a meeting site for Forest Service Management Policy Seminars, the Senior Executive Service Candidate Development Program, the "Urban-Wildland: Issues and Opportunities" conference, co-sponsored by the Conservation Foundation; and numerous smaller regional meetings.



# *Forest Research*



## INTRODUCTION

Forest Service Research develops scientific and technical knowledge to enhance and protect economic productivity and environmental quality on all of America's 1.6 billion acres of forests and associated rangelands. The Forest Service has the most extensive and productive program of integrated forestry research in existence. Our investigators devote special attention to multifunctional and long-term natural resource issues of national and international scope. These are the types of scientific issues for which the Forest Service's research continuity, geographic scope, and multidisciplinary skills are particularly well suited. Research results provide new knowledge and technology that reduce the costs, improve the productivity, and enhance the efficiency of forest management while protecting or improving environmental quality.

New information and technology that emerge from completed research benefit nearly every major forest and rangeland ecosystem. The eight regional Forest and Range Experiment Stations and the Forest Products Laboratory in Madison, Wisconsin, conduct studies that range geographically from the tropics to the Arctic and from Hawaii and territories in the Pacific to Puerto Rico in the Atlantic. More than 2,800 studies are in progress at any one time, involving approximately 718 Forest Service scientists stationed at 74 locations.

The Forest Service plans and coordinates its research with related efforts at the 61 forestry schools and the agricultural experiment stations of land grant institutions throughout the United States. Forest Service scientists also work closely with researchers from other public agencies and the forest industry.

Many of our scientific results, including some described in this report, are used primarily to help manage America's national forests. Other major users of Forest Service research results include a broad array of Federal, State, and pri-

vate land managers; public policy officials from all levels of government; and the wood-based industries, such as pulp and paper, housing, and furniture manufacturing. Research results are communicated to these clients through publications (table 54), symposia, workshops, and direct public contact.

The research program also supports international forestry through cooperation with other Federal agencies, nongovernment organizations, the United Nations, and bilateral arrangements with a number of foreign countries.

In 1988, research appropriations totaled \$136 million, approximately 11 percent of which supported cooperative studies with colleges, universities, other research organizations, and industry (tables 51 through 53). The Forest Service transferred an additional \$3 million to the Cooperative State Research Service for administering the Forestry Competitive Research Grants Program. The Forest Service received supplemental research support totaling \$23.6 million from other sources, such as government agencies concerned with forest and rangeland management, and various private-sector institutions, such as the Boyce Thompson Institute and the Institute of Terrestrial Ecology. About 30 percent of these outside funds were awarded in turn for extramural research.

## PRIORITY RESEARCH PROGRAMS

During 1988, the Forest Service identified six priority research programs for future emphasis. Each encompasses large, complex resource problems involving broad geographic areas and multiple disciplines.

### Forest Health and Productivity in a Changing Atmospheric Environment

Acid rain and other air pollutants have become a major environmental issue in the United States. This problem has international dimensions that affect U.S.

relations with neighboring countries. The Forest Service's atmospheric deposition research focuses on determining chemical characteristics of this deposition and assessing its effects on terrestrial and aquatic ecosystems. We are also evaluating the current chemical climate of wildlands to find out whether and how land and water resources may be changing in response to acid rain. This research is a major part of the interagency National Acid Precipitation Assessment Program.

Our scientists are studying atmospheric deposition in the following ecosystems: California and Pacific Northwest forests, Rocky Mountain high-elevation forests and alpine ecosystems, commercial pine forests of the South and Southeast, eastern mixed hardwoods, and the spruce forests of the East.

Forest Service research has determined that sulfate deposition is increasing in the southeastern United States, and some watersheds can no longer buffer its acidifying effects. Soil organic matter plays a key role in reducing the effects of acidic rain on the leaching of soil nutrients in New England. Peat, if present in soils, absorbs acidic deposition rather than passing it through to lakes in peatland watersheds. Acidic rainstorms and rapid melting of acidic snow increase the acidity of lakes and streams; although this effect is only temporary, it can be significant ecologically.

Watershed studies in New England, Pennsylvania, the central and southern Appalachians, the northern Lake States, and the south-central United States have determined how watersheds interact with acid rain to produce changes in soil, water, and vegetation. For example, acid rain has been found to interfere with calcium uptake in conifers, reducing tree growth.

High levels of ozone have been shown to cause death of some forest trees and to bring about significant changes in forest ecosystems. Moderate levels of ozone have also been determined to cause foliar damage in trees.



Acidic deposition and ozone production are only two areas where results of human activities are affecting forest and rangeland health. Long-term trends in temperature and the chemical composition of the atmosphere may also be important. Therefore, we are broadening our research beyond the atmospheric deposition research program to encompass effects of "greenhouse gases", global climate change, and other forest-atmosphere interactions.

### **Wildland/Urban Interface**

The wildland/urban interface occurs where large urban areas are adjacent to State, Federal, and private forest lands. When towns and exurban developments, such as vacation communities, spring up next to forests, managers face major problems in fire protection, land-use planning, and recreational use. The possibility of fire disasters involving substantial loss of life and property in these wildland-fringe developments increases, as the 1988 fires in the Greater Yellowstone Area and California attest.

The Forest Service is developing fire safety and planning guides, fire-behavior prediction systems, and fire suppression tools for use in these high-value areas that are subject to heavy use and great fire risk. The goal is to provide new management concepts and tools to aid local officials and residents in solving the special problems of the wildland/urban interface.

### **International Trade and Competitiveness In Timber and Wood Products**

Although we export about 15 percent of the timber products we produce, America is the world's largest importer of forest products. Our vast timber resource provide a base for the Nation to expand wood and wood product exports, increase domestic employment, and help improve the overall foreign trade balance.

The Forest Service's economics research helps policymakers formulate strategies for increasing exports of wood. We analyze current trade flows, identify factors influencing trade flows, improve methodologies for trade analyses, and assess the present and prospective effects of international trade on domestic timber resources.

Our research is providing insights on trends and effects of policy changes. For example, exports of eastern softwood solid wood products totaled \$443 million in 1987 and have increased 50 percent since 1985. Last year, plywood replaced lumber as the leading softwood export from the South and accounted for 58 percent of total U.S. softwood plywood exports. Log and lumber exports from the Pacific Coast states, mainly to the Pacific Rim, are projected to set new records at over \$3 billion in 1988. If log exports from State lands in Oregon and Washington were to be banned, export log prices would rise about 12 percent and their volume would decline about 7 percent in the short run. In the longer term, substitution of logs from private lands for logs from public lands would reduce the increase in price to something less than 12 percent.

We have accelerated our study of the effect of international trade on domestic forest resources, of tariff and nontariff barriers on forest products trade, and of changing pulp-manufacturing technology on world trade in pulp and paper products.

### **Pest Outbreaks**

Insect and disease pests kill more than 2.4 billion cubic feet of timber each year, most of which remains unsalvaged. Growth losses, attributable to pest damage, are almost that high, and pest impacts on recreation and wildlife resources are often substantial. Pest outbreaks have become both more frequent and more severe during the last 20 years, partly because America's forests are increasingly susceptible to pest attacks.

Managers need tools that ensure early warning of impending outbreaks, cheaper and more effective techniques to stop or lessen them, and ways to reduce environmental hazards that could result from control actions. There are at least six reasons why effective insect and disease management techniques are more important today than in the past:

1. With successful fire control, many forests are changing in age and species composition in a way that makes them more susceptible to pests like the spruce budworms and root diseases.
2. Nationally, many unmanaged pine stands are overmature and densely stocked--characteristics that make them more prone to bark beetle attacks.
3. Common management practices, such as using one tree species over large areas, preserving stands of mature trees, and planting species not native to particular sites, raise the risk of insect and disease attack.
4. Disturbances from more-intensive management activities increase the occurrence of and damage by certain pests, such as root diseases.
5. Environmental and human health concerns make traditional chemical pesticides less acceptable.
6. New pest problems arise for which new controls are needed. The gypsy moth, a prominent example, continues to expand its range of damage to new areas.

The Forest Service initiated the pest outbreak priority research program to put more emphasis on developing safe, effective tactics for delaying and suppressing outbreaks of major forest pests. This program includes studies on the southern pine beetle, the gypsy moth, the western spruce budworm, root rot diseases, cone and seed pests, nursery pests, and the pinewood nematode.

### Critical Wildlife and Fish/Timber Management Interactions

Managing for multiple resource outputs can result in conflicts between protecting wildlife and fish and providing a consistent flow of forest products from the resource base. In the Pacific Northwest, for example, significant acreages of old-growth Douglas-fir forests are being reserved from timber harvest to maintain habitat for the northern spotted-owl. Before we can successfully integrate species conservation with the production of forest outputs, more knowledge is needed about wildlife and fish habitat requirements and their relation to timber management.

High priority is being given to studying those species most likely to be affected by planned forest management activities--wildlife associated with old-growth forest habitats, interactions between timber management and fish, and threatened and endangered species.

For example, our current research has found that timber harvests can be increased by up to 20 percent from Florida's national forests without compromising the red-cockaded woodpecker's habitat or endangering the species' survival. Research on cavity-nesting birds and mammals has shown how to manage forests to meet the needs of many of these species and still maintain efficient timber management programs.

The Forest Service has planned or initiated expanded research programs on critical interactions between timber and wildlife in a number of areas. With regard to the northern spotted-owl, for example, our investigations center on this species' habitat use, movements, breeding activity and success, juvenile dispersal, prey ecology, and potential competition with barred owls. Results of this research will help minimize the economic impact of providing for spotted-owl habitat. We are planning similar research on the Sitka black-tailed deer in Alaska, the grizzly bear, elk and

deer in Oregon, and cold-water fish habitat in the Appalachian Mountains.

### Southern Forest Productivity

Although we will depend on the South to produce enough wood to meet half the Nation's needs by the year 2000, the southern timber resource may not be able to support continued expansion of forest industries as it did in the 1970's. Net annual growth of softwoods in the South has leveled off and in some areas it has begun to decline. Mortality from insects and diseases is increasing at a significant rate. Manufacturers currently perceive a scarcity of high-quality southern hardwood timber. A comprehensive review of the timber situation has revealed that, unless timber growth is improved, the South is facing a future of rising prices for raw materials, much lower rates of growth in forest stands, and declines in employment in the forest industries.

The Forest Service has accelerated research to help meet future demands on this resource. The program will address how to enhance timber growth on southern forest lands, the competing uses of the southern forest resource that reduce timber yields, conflicts of use that can be avoided or resolved, and management techniques that can ensure increased timber production and other uses without adversely affecting the environmental quality of these lands.

The program will apply biotechnology to accelerate tree improvement, and conduct quantitative studies to better understand the biological processes and environmental factors affecting productivity. Research will seek to develop silvicultural alternatives for control of unwanted vegetation, integrated pest management strategies as alternatives to overdependence on chemicals, practices for both timber and habitat management to maintain and protect wildlife populations and watershed values, and improved methods of harvesting and wood utilization to extend and protect the resource.

### 1988 RESEARCH HIGHLIGHTS

#### Fire and Atmospheric Sciences Research

The objectives of this activity are to develop improved knowledge of the initiation, behavior, and effects of fire in forest and range environments, to use that knowledge to develop better methods of preventing and controlling wildfires and to use prescribed fires for enhanced forest resource protection and production, and to better understand atmospheric effects on forest productivity and health, along with biosphere-atmosphere relationships. Examples of 1988 research accomplishments follow.

- ▼ A joint research project involving the University of Montana, the USDI Bureau of Land Management and National Park Service, and our Intermountain Research Station now makes it possible for forest and rangeland managers to consult a computerized data base to find out how fire affects nearly 200 plant species and a dozen animal species in the West. The Fire Effects Information System documents how both wildfire and prescribed burning alter species distribution and characteristics and change resource values. These data help decision-makers effectively use fire to manipulate vegetation for better management of range, wildlife, and timberland.
- ▼ A firefighter's goal is to be in the right place with the right equipment at the right time--when fires are still small. Forest Service research is concentrating on weather forecasting, fire danger ratings, and historical records of fire occurrence to sharpen our ability to allocate and transport firefighting resources cost effectively. We have devised methods to predict relative humidity and wind out to 30 days with useful reliability. These forecasts, coupled with traditional ones for temperature and rainfall, make up fire behavior and drought





*A firefighter battles the Colville Fire during the summer of 1988 in Washington State. Our fire research helps us get people and equipment to the right location before wildfires get too large.*  
Photo by Yuen-Gi Yee

indices for predicting fire severity. Our fire danger research determines the moisture content of live and dead vegetation, how much vegetation will be consumed in a fire, and the intensity and rate of spread of fires. In studying historical records of fire occurrence and burning conditions on several national forests over 15 years, scientists at the Pacific Southwest Station found that a measurement called the burning index (BI) closely correlates with major fires that took place in the past. When present-day weather and fuel conditions resemble those of the past, managers can use today's BI for a particular location to indicate current fire danger. The big payoff for this research lies in using BI figures, weather forecasting, and cost data to preposition firefighting personnel and equipment where large fires are most likely to occur.

▼ Concentrations of nitrogen oxides (NOx) are rising in the Earth's atmosphere--a situation that can enhance the famous "greenhouse effect" and speed global warming. Though soils in undisturbed forests release almost no NOx, scientists knew little about NOx release from burned soils until now. Pacific Southwest Station researchers recorded NOx fluxes from soil both immediately after and 6 months after burning. The high readings, plus the fact that between 2 and 5 percent of the planet's surface is burned every year, strongly suggest that the global NOx budget cannot be defined accurately without taking fire into account. This research should lead to a better understanding of the feedback mechanism operating among the formation of NOx, global warming, and fire occurrence--a chain of events that could threaten the long-term stability of forests everywhere.

## Forest Insect and Disease Research

Our insect and disease research develops information and technology that prevents or reduces forest and rangeland damage by insect and disease pests and that protects wood in use and storage from insects and decay. The goal is to help develop environmentally safe and effective strategies for pest management that can be integrated with forest resource management and wood protection programs. Examples of 1988 research accomplishments follow.

▼ Subterranean termites cause \$750 million worth of damage annually to homes and other wooden structures in the United States. The Environmental Protection Agency (EPA) recently suspended the use of several long-lasting termiticides developed in the 1960's. Anticipating such a ban, Forest Service Research started 22 years ago to develop termite-control chemicals that would not persist so long in the environment. Scientists at our Gulfport, Mississippi, laboratory tested the best candidates at four locations nationwide and found five alternative chemical treatments successful for at least 5 years--the minimum EPA standard. These five have been registered, labeled, and marketed since 1980 (two in 1988 alone), offering U.S. homeowners a safer alternative for protecting their largest single investment against the most feared insect pest.

▼ "Acid rain" may be one of the causes of red spruce growth decline and premature death in the Northeast, but not by the simple mechanism of "burning" foliage. Researchers at the Northeastern Station have found that calcium uptake from forest soils--an essential precursor to plant growth--is blocked when acidic precipitation frees up excess aluminum in the soil. When trees produce less new sapwood, they become stressed and unable to handle invasions of disease and insect pests. Cooperative research in the



*Fire research activities at a controlled burn on the Angeles National Forest in California. After the fire, an unexpected high production of NO<sub>x</sub> burned soils was recorded. The feedback among the formation of NO<sub>x</sub>, global warming, and fire could pose a threat to America's national forests.* Photo by Colin C. Hardy

Northeast continues, along with investigations in West Germany and Yugoslavia--all aimed at determining the extent and severity of aluminum-induced calcium deficiency in forest trees. Better understanding of how trees are made more vulnerable by such mineral imbalances can help us relate overall tree health to forest management practices, as well as to acidic deposition.

- ▼ Fusiform rust disease kills or deforms a high percentage of recently planted loblolly pines from South Carolina through Mississippi. Finding, breeding, and planting rust-resistant pines is the most promising way to limit losses. In the 1970's, Southeastern Station scientists found that some loblolly pines are resistant to fusiform rust. Researchers selected cones from these trees and raised seedlings, exposing them in the laboratory to the disease. Seedlings that survived are now being grown in quantity at a

Georgia Forestry Commission seed orchard, and outplanting these resistant strains is cutting fusiform losses in pine plantations by 50 percent.

- ▼ Killing insect pests with chemicals can be harmful to the environment. But using microbials--sprays made from the viruses and bacteria that normally cause disease in pest insects--is effective, practical, and safe. Scientists at the Northeastern and Pacific Northwest Stations have developed and registered four new microbials: the viruses Gypchek (for use against the gypsy moth), TM Biocontrol-1 (against the Douglas-fir tussock moth), and Neocheek-S (against the European pine sawfly); and a more potent strain of the bacterium *Bacillus thuringiensis* (Bt), (registered for forest defoliators, including the gypsy moth, the Douglas-fir tussock moth, and the spruce budworm). The particular advantage of microbial pesticides is that they can protect sensitive eco-

logical sites and urban settings without risk to the environment or human health.

### Forest Inventory and Analysis

This activity provides comprehensive, continuing information and analyses of the characteristics of forest land resources of the United States. Forest industries, financial consultants, and State resource planners use forest inventory data, monitoring surveys, and results of analyses as a basis for industry expansion decisions, financial investment analysis, State forestry programs, and public and private forest policies.

- ▼ The Forest Service has completed New England's latest forest inventory, and the region has set new records for timber stocking and size. Compared to statistics from the last inventory, 10 years ago, the region's forests contain 14 percent more timber volume, and the volume is found in bigger trees. Timber volume in trees with trunks at least 16 inches in diameter is up by a whopping 41 percent. Net annual growth is nearly double removals, which means that the region's inventory of growing stock continues to build. New England's increasing timber supply provides a major opportunity for significant expansion in wood use. Despite the constraining effects of wildfire, gypsy moth, hurricanes, drought, and air pollution, the Northeast's timber resource continues to thrive.
- ▼ Every 10 years, the Forest Service assesses the available supply of and future demand for all renewable resources under the auspices of the Forest and Rangeland Renewable Resources Planning Act (RPA). We identify potential timber resource problems and opportunities to expand timber markets based on our projections of demand for wood products, including wood fiber for pulp and paper, 50 years into the future. For the 1989 RPA



Assessment, Forest Products Laboratory researchers developed a computer model that provides long-range projections of fiber consumption and technological change in the U.S. pulp and paper industry. The model forecasts substantial increases in consumption of hardwood pulpwood and recycled fiber and moderate increases in consumption of softwood pulp. Federal, State, and private industry officials can use this information in making policies and plans to meet timber resource needs for the next century.

- ▼ Timber is the highest valued individual agricultural crop in the South, and timber-based manufacturing employs more people and pays out more in wages than any other manufacturing industry there. When our survey data indicated early in the 1980's that the net annual growth of southern timber is less than in the past, we initiated a comprehensive new assessment of the outlook for timber supplies in the South, through 2030. Assuming that current management trends continue, the region can expect rising prices for timber and timber products, and slowing growth in timber harvests. The study also identified ways to alter these trends through increased tree planting and more intensive management of the softwood resource. Public and private-sector organizations will use the results of the southern timber study to plan the programs and policies that will shape the South's forests in the 21st century.

### Renewable Resources Economics Research

Our economics research develops and applies methods for analyzing forest management investments and the responses of domestic and international forest-products markets to economic, technological, and institutional forces. Research contributes directly to national forest management decisions and to the development of both public and private forest management programs.

Individual landowners and forest-products processing firms use the results to manage their resources efficiently.

- ▼ The Federal income tax can be an important influence on forestry investment decisions. The 1986 Tax Reform Act greatly affects timber owners by eliminating lower capital-gains tax rates for timber profits. Economists at the Southern Station analyzed the 1986 law and developed guidelines for timber owners, operators, and investors. The goal of this research is to help both woodland owners and their advisors to understand how changes in the U.S. Tax Code alter their own particular situations.
- ▼ In 1986, the Secretary of Agriculture asked us to study the cumulative effects of timber sale levels on the economies of small rural communities. Our timber supply study in Montana led to the development of an interactive computer program enabling our employees and the public to get help in forest planning. The Montana Timber Market Model estimates future prices and supply and demand for stumpage, estimates changes in employment and income in timber-dependent towns, and describes the characteristics of Montana's timber resource over time. The model is available through our computer system to Agency users and to the general public on diskettes.
- ▼ To regenerate conifers successfully, managers must control competing hardwood sprouts and weeds. Mechanical methods of control are becoming increasingly expensive and can cause soil erosion. Herbicides, properly applied, can successfully control competing vegetation without harmful effects on the forest environment. But which method is most cost effective? Southern Station economists developed a model for determining whether chemical or mechanical site preparation is more cost effective, given a variety of site conditions and assumptions about the level of hardwood control required. Their analysis indicates that chemical site preparation is the most cost-effective treatment where stocking of hardwoods on the site is moderate to heavy. Mechanical methods are preferable where hardwood stocking is light.

### Forest Recreation Research

Our recreation research provides land managers with the technology to supply more and higher quality outdoor recreation opportunities, both in forest and range settings and in urban environments.

- ▼ During the 1950's and 1960's, recreational use of wilderness increased about 10 percent per year. Recent surveys by the Intermountain Station, however, indicate that the average increase in wilderness recreation is now about 3 percent. Some of the slower growth is due to additions to the National Wilderness Preservation System, which is now 6 times as big as it was 15 years ago. Managers still have to cope with heavy use in many areas, but limiting public access and tight regulation of visitors in some areas seem less necessary now than in the late 1970's.
- ▼ Managers of forested outdoor recreation sites have long noted that urban black Americans are under-represented among users. Cooperative research by the North Central Station and the University of Michigan has provided a much clearer picture of the importance inner-city blacks place on the natural environment and the specific site attributes they prefer. Urban blacks tend to prefer sites characterized by openness, visibility, and neatness rather than dense vegetation. Urban blacks are also likely to prefer buildings on the sites. Awareness of these preferences can help planners and managers provide forest recre-



*In the 1950's and 1960's, Americans' use of wilderness for recreation increased 10 to 12 percent every year. Recent studies indicate that such use has leveled off or even declined in some areas.* F.S. Photo

ation environments that will encourage use by urban blacks.

### Trees and Timber Management Research

This activity seeks to develop improved silvicultural alternatives and management guidelines to increase the productivity and multiple-use benefits of forest lands, to maximize the growth and quality of trees, and to maintain healthy forests. Timber management research ensures that the information and technology needed to achieve full productivity are developed and promptly made available.

- ▼ Research in Southeast Alaska has provided a better understanding of how to improve forage in second-growth stands (the kind that follow clearcutting). Untreated second-growth stands greater than 20-30 years old are of limited value to wildlife because canopy closure shades out important food plants resulting in poor forage quality and

quantity. Creating artificial gaps in the canopy or maintaining natural gaps, in conjunction with carefully designed old-growth habitat areas, improves our ability to maintain biological diversity and improve wildlife habitat quality.

- ▼ Often, herbicides are just as fatal to desirable tree species as to nearby weeds. But by employing tissue culture techniques, North Central Station scientists scored a scientific first: they developed a hybrid poplar that can withstand laboratory applications of two widely used herbicides. Tests will begin next year to determine how well these genetically selected trees will perform in the field. Production of other herbicide-tolerant trees, such as high-quality hardwoods, could further accelerate tree growing for the benefit of several forest product industries.
- ▼ Though periodic prescribed burning is the cheapest way to reduce the

encroachment of woody competition in southern pine stands, Southern Station scientists found that over a 10-year period, growth of young longleaf pine was not enhanced by biennial applications of prescribed fire. Biennial handclearing of all woody vegetation did not improve longleaf pine growth either. This surprising result is sending our investigators back into the field to observe the effects of burning young longleaf pine stands every third and every fifth year.

- ▼ The Forest Service founded a research consortium in 1979 under the U.S. Man and the Biosphere Program to seek workable solutions to the problems of tropical deforestation. Under the direction of a scientist from our Institute of Tropical Forestry in Puerto Rico, the consortium funded 20 tropical studies that cost around \$1 million, mostly from Forest Service funds to address these deforestation problems. This research has so far yielded over 60 papers on ecology and forestry and agroforestry. Papers from the recently published "People and the Tropical Forest" suggest that cautious optimism about the future of tropical forests is in order. Specifically, this research has identified sound tropical-forest management principles that take into account local cultures, sustained-yield techniques where forestry of this type was not thought possible, and unproductive or damaging practices that should be set aside. Considering the importance of tropical forests in maintaining Earth's atmosphere, everybody on the planet stands to benefit from this research.

### Watershed Management and Rehabilitation Research

Our watershed research aims to develop and test new, cost-effective methods for rehabilitating lands disturbed by surface mining and for protecting, managing, and improving forest and





*Our herbicide-tolerant poplar clone is the first example of useful chemical tolerance induced in a forest tree species through tissue culture. The plant on the left is an unsprayed parent clone. On the right is a selection of the same clone that remained undamaged after application of a popular herbicide during greenhouse testing.* Photo by Ed Bauer

puter growth simulator--a program that mathematically "grows" a group of trees and models the growth interactions between them and shrubs under different levels of weed control. SYSTUM 1 not only helps managers pick the best silvicultural regime to achieve their goals, but also can predict how silvicultural treatments will affect wildlife habitat.

### Wildlife, Range, and Fish Habitat Research

This research develops knowledge and technology for maintaining or improving wildlife and fish habitat; for improving vegetative cover and condition of rangeland; and for integrating wildlife, fish, and livestock production with other forest and rangeland uses. Research results help managers understand the complex relationships among habitat requirements of fish and wildlife species, expected habitat changes as a result of management activities, and the dynamics of wildlife and fish populations. The goals of this research are to provide information to maintain high quality habitats for fish and wildlife and to conserve and improve productive rangeland ecosystems.

- ▼ Forest managers throughout the South recognize the importance of protecting populations of the endangered red-cockaded woodpecker. Research at the Southern Station has revealed that to enhance populations of this species, managers need to change their harvesting patterns by leaving some mature pines. The red-cockaded woodpecker excavates nesting cavities in 80 to 120 year-old pines, probably because such trees often exude quantities of a sticky resin that keeps away tree-climbing predators. Selectively leaving behind uncut trees in a modified shelterwood harvest produces the kind of open pine savannah habitat that this bird prefers and also ensures a seed source and shelter for the regenerating pine stand that will furnish wood in the 21st century.

rangeland watersheds. Such research strives to help planners and managers meet long-term water quality and flow needs, rehabilitate surface-mined lands, and determine the relationships between land uses and water quality and flow.

- ▼ Managing America's water resources is especially critical in parts of the West, where snowfall greatly affects streamflow. In heavily forested areas, our researchers have found that much of the snow caught on tree branches simply evaporates.

Clearcutting leads to much higher streamflow, but studies at the Fraser Experimental Forest in Colorado have shown that partial cutting (individual tree removal) can enhance water supplies.

- ▼ Managers know that competing vegetation (weeds and "undesirable" tree species) affects forest productivity, but until the Pacific Southwest Station developed SYSTUM 1, they could not estimate just how serious the competition problem is in a given stand. SYSTUM 1 is a microcom-

▼ Forest Service research is continuing to provide new knowledge about the habitat requirements of the spotted-owl and other species commonly found in old-growth forests. In the Klamath Mountains of northern California and southwestern Oregon, researchers from the Pacific Southwest Station are gathering information on the size and composition of spotted-owl home ranges. They have learned that in the Klamath Mountains, a pair of spotted-owls typically moves throughout a 3,000 acre area of forest but does not use all of it. Our scientists will determine which portions of these areas the owls use and the specific characteristics of these selected

habitats. The purpose of this research is to provide managers with guidelines for spotted-owl habitat management.

▼ Pinyon pine and juniper grow on more than 5 percent of the Nation's rangelands, and the acreage is increasing. The forage produced on these rangelands is of critical importance to the western livestock industry. Research at the Intermountain Station in Nevada has demonstrated how pinyon pine and juniper invade shrub and grass communities and eventually dominate the landscape, to the exclusion of valuable forage plants. Our investigations revealed that livestock

grazing is not the primary cause of pinyon-juniper expansion. We have also learned how to intervene by harvesting trees or using prescribed fire to renew biological diversity, increase forage production, and improve wildlife habitat.

▼ Many owners of forest land in the South want to grow pine trees and provide forage for farm animals as well, but heavily stocked pine stands do not permit luxuriant vegetation to grow beneath the forest canopy. At the Southern and Southeastern Stations, researchers discovered that wide-row and multiple-row pine planting configurations are compatible with forage production. No longer do southern landowners have to choose between growing trees for profit and growing forage for their grazing stock. This multiple-use approach to land management supports food and timber production while enhancing recreation and wildlife habitat.

▼ The Forest Service manages 191 million acres, much of which produces forage for wildlife and domestic livestock. Increasing demand for this forage and for water, timber, and recreation from these acres led to a cooperative research-management program for evaluating current and potential production of range resources and the role of grazing. Results are now in from 11 years of studies at the Southern, Pacific Northwest, and Intermountain Stations--investigations that involved 80 cooperating organizations and individuals and yielded 150 publications. The southern range evaluation project led to improvements in managing southern pine forests for forage production. The Oregon project concentrated on studies of herbage and browse, water yield, wildlife, timber, and recreational opportunities. The Great Basin program, involving two ranch projects, improved the production coefficients used in several



About 2,500 pairs of spotted-owls are thought to live in mature and old-growth forest stands in the forests of Washington, Oregon, and California. These juveniles have left the nest and after two years will be searching for mates and territories of their own. Photo by Andrew Carey



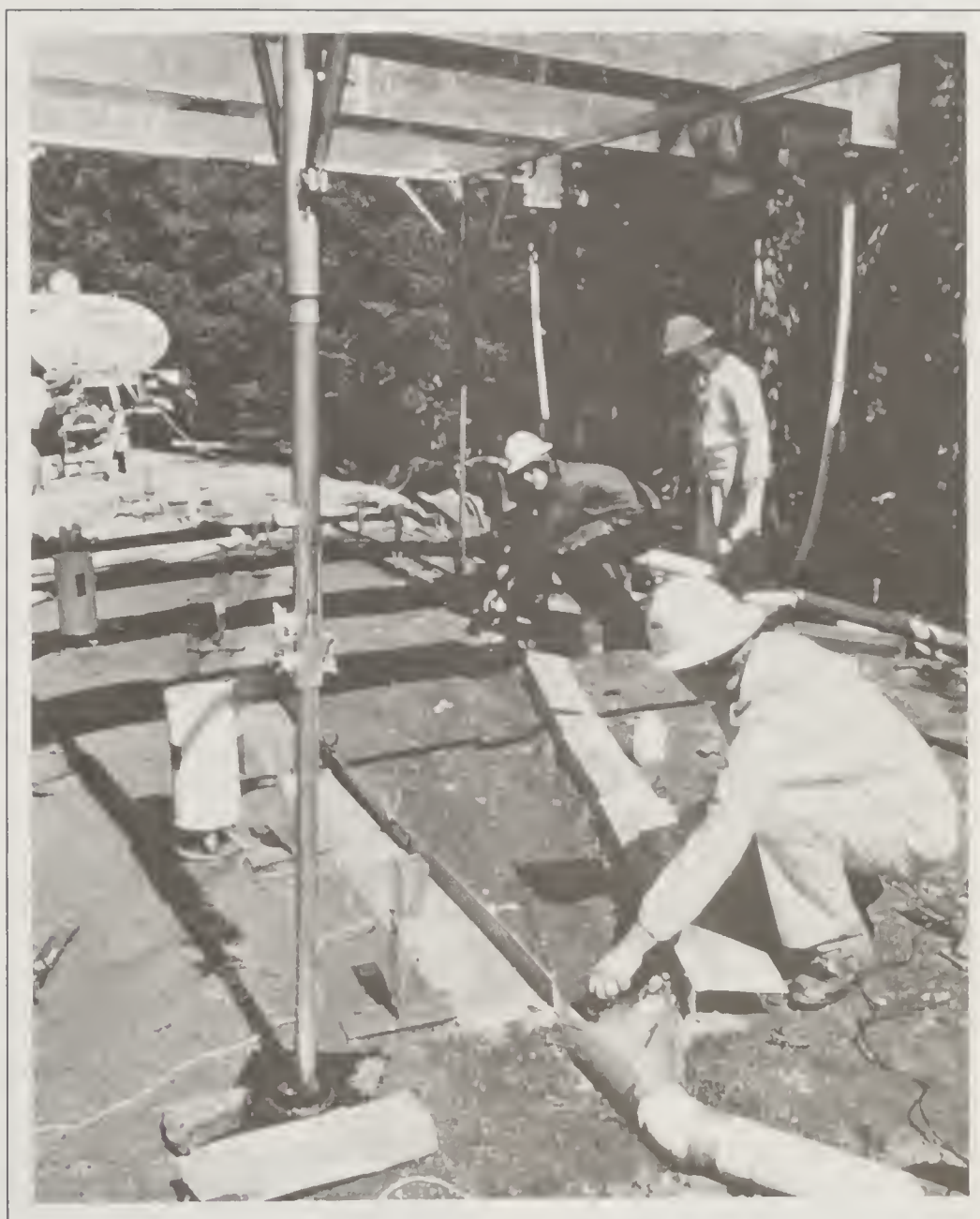
predictive models, developed range-improvement strategies, and demonstrated range-improvement practices.

### Forest Products and Harvesting Research

The objective of this activity is to provide information and technology to harvest and use timber more effectively. This includes research to develop basic information that can lead to new wood-based products or processes; to improve the performance and increase the value of wood products; to expand opportunities for wood products exports; to reduce waste, costs, and energy consumption in wood processing; and to develop timber harvesting and transporting systems that are efficient, economical, environmentally acceptable, and integrated with other forest management operations.

- ▼ Some forest management activities, such as road building and preparation of timber sites for harvest, can temporarily increase surface erosion and sediment production. Intermountain Station scientists, working with the USDA Agricultural Research Service and Soil Conservation Service and the USDI Bureau of Land Management, are using simulated rainfall to compare sediment production from vastly different soils and management practices in sites in the Rocky Mountain West and Southeast. The comparisons have resulted in a computer model that will help forest managers to better gauge the impact of land management activities and to determine environmentally sound and cost-effective management practices that help maintain long-term soil productivity.

- ▼ The Forest Service builds or reconstructs about 7,000 miles of forest roads annually, and finding cheaper ways to do this without compromising the forest environment is a high priority. North Central Station scientists, in cooperation with the Eastern Region and the Missoula Technology



*Simulated rainfall applied to forest roads and harvest areas provides data to compare sediment production from different land management treatments and different soils. F.S. Photo*

Development Center, have developed a new way to make forest roads out of fist-sized "chunkwood"--what is left after a wood chunker gobbles up the trees cleared to lay the roadbed. This new road material performs well in swamps, in both wet clay and dry sandy soils, and in mudholes in conventional roads. Using chunkwood will reduce our road building costs, conserve gravel resources, eliminate unsightly gravel pits, and provide a market for the

otherwise unmerchantable trees cleared for the roadway.

- ▼ Extensive research on the structural, fire-resistance, and environmental performance of wood has been completed at the Forest Products Laboratory. This research defines--for the first time--the relationship between materials, construction methods, and building performance. We have developed reliable informa-

tion on the strength of all grades of 2-inch dimension lumber of traditional softwood lumber species and two hardwood species. In light of this research, reliability-based design concepts can be applied in building wooden structures.

## INTERNATIONAL FORESTRY

The International Forestry program provides leadership, coordination, and direction for Forest Service activities with other countries and international organizations. In 1988, the Forest Service:

- ▼ Expanded cooperation with the United Nations' Food and Agriculture Organization through its Tropical Forestry Action Plan by:

- sponsoring a workshop in Jamaica on tropical forestry for senior decisionmakers from Latin America,

- participating in a regional assessment of the forestry sector in the eastern Caribbean,

- participating in an assessment of forestry development in southern Mexico, and

- sponsoring an associate professional officer on a long-term assignment in Indonesia.

- ▼ Participated in a Service-wide task force to examine the role and policy of the Forest Service in international forestry.
- ▼ Advanced 26 cooperative research projects in 7 countries. Projects addressed new technologies in agroforestry, fire management, wildlife management, insect and disease protection, regeneration, tree genetics, watershed management, and forest products utilization.
- ▼ Hosted more than 300 forestry and natural resource students and pro-

fessionals from 50 other countries, including 30 participants in the fourth annual International Seminar on Forest Resource Administration and Management.

- ▼ Participated in 18 science and technology exchanges with 11 countries in Eastern and Western Europe, Asia, Oceania, and Latin America. The Forest Service gained new tree and insect germplasm, data on atmospheric deposition, information on forest products technology and marketing, access to unique equipment for modeling stream channel morphology, and new management approaches to urban forestry and parks.

The International Forestry program continued to work in close cooperation with the U.S. Agency for International Development (AID) and the USDA Office of International Cooperation and Development (OICD), primarily in developing countries, through the Forestry Support Program (FSP) and the

Disaster Assistance Support Program (DASP).

## The Forestry Support Program:

- ▼ Supported major agroforestry training activities, including one 3-week course for 24 technicians in Bolivia and another for 25 Caribbean and Pacific Island foresters held in Costa Rica and a 1-week course for 18 forestry and agriculture extension agents in St. Vincent. In cooperation with CARE, we helped develop an agroforestry extension handbook and, with Save-The-Children, the publication "Planning for Agroforestry."
- ▼ Cosponsored an international conference on educating forest technicians into the 21st century, at Paul Smith's College, New York, for some 50 participants from about 20 countries and a highly successful "Natural Resources and Disaster Management Roster Managers' Workshop" in Washington, DC, for



*Technical consultations are a major activity of International Forestry's Forestry Support Program. Here Tim Resch (right) consults with a Gambian Forestry Department colleague on a USAID-funded development program. Photo by Tim Resch*



28 organizations to share information and explore opportunities for interroster cooperation.

- ▼ Prepared a biological diversity assessment for AID in Morocco and helped draft a similar assessment for AID in Botswana.
- ▼ Helped in the early formulation of a likely new AID-funded agroforestry project in Haiti, a natural resources management project in Niger, and a new Peace Corps-World Food Program on integrated rural development activity in Tunisia.
- ▼ Maintained the resumes of 2,500 natural resource managers on a skills roster and completed nearly 150 computer searches to identify resource specialists for international forestry assignments.
- ▼ Conducted a Peace Corps-AID food aid and natural resources coordinating workshop in Guatemala for the Latin America region.
- ▼ Sponsored through the Forestry Private Enterprise Initiative, workshops, field demonstrations, and research on small-scale enterprises in the forest-based sector and the use of wood for construction in Ecuador.
- ▼ Initiated start-up activities for long-term cooperation with AID and the Honduran Forestry Service on a major forestry development project in Honduras.

#### **The Disaster Assistance Support Program:**

- ▼ Sponsored and implemented major international fire suppression training courses in Ghana, Mexico, and Indonesia.
- ▼ Provided technical experts to AID for assisting in grasshopper and locust control activities in Mali, Mauritania, Morocco, Tunisia, and Sudan, where

outbreaks of these damaging pests were occurring.

- ▼ Organized, designed, and implemented a workshop on evaluating the grasshopper and locust control campaign, for 70 participants to review the 1986-87 Africa campaign and provide recommendations to improve future control activities.
- ▼ Organized a fire management technical exchange for AID that sent three U.S. fire management specialists to Argentina in February and March and brought 16 Argentine specialists to the Western United States in August.
- ▼ Furnished a geologist to AID to conduct a landslide hazard assessment in St. Vincent and the Grenadines.
- ▼ Conducted disaster-simulation exercises, training, and workshops in Arizona, Maryland, Washington, DC, Argentina, Costa Rica, Venezuela, and Thailand to improve the efficiency and effectiveness of international disaster-assistance operations.

### **COMPETITIVE GRANTS**

The objectives of the competitive grants program are to support fundamental research that addresses critical barriers to the advancement of scientific wood utilization, and to further knowledge of biological mechanisms of forest organisms and their ecological relationships that contribute to the health and productivity of forest resources. Congress appropriated \$3 million in 1988 to this program for forestry research and stipulated that the funds be equally divided between two areas--(1) basic improved harvesting, processing, and utilization research, and (2) basic forest biology, including biotechnology.

The Competitive Research Grants Office of USDA's Cooperative State Research Service administers this program. Scientists selected from the research

community serve as program managers or members of peer review panels. Federal employees serve as associate program managers.

Procedures for awarding grants are based on a competitive evaluation process similar to that used by the National Science Foundation--a process concerned primarily with the scientific merit of a submitted proposal. All qualified scientists in the United States are eligible for grants, including Federal scientists. In 1988, 235 proposals (requesting \$40.4 million) competed for the \$2.844 million available for grants. Of the 22 proposals funded this year, 6 were renewals of previously funded proposals; the average grant was approximately \$130,000 for a 3-year period.

In 1988, the Forestry Competitive Research Grant program funded proposals in the following fields:

Proposals Funded		(% of Funding <u>Awarded</u> )
Wood Utilization Program:		
Chemistry & Biochemistry	4	(15%)
Processing	6	(24%)
Anatomical & Physical Properties	2	(6%)
Structural Engineering	1	(5%)
Harvesting	0	
Forest Biology Program:		
Genetics & Biotechnology	5	(32%)
Physiology	2	(10%)
Ecology	2	(8%)

In 1988, 91 percent of the funds went to principal investigators working at colleges and universities and 9 percent to Forest Service principal investigators. Scientists from different institutions often cooperate as coinvestigators on research projects.

The following are examples of research findings from grants given in prior years:

- ▼ The water-conducting system of a tree is severely impaired when air gets in, yet air-filled cells in branches

are not uncommon during periods of water stress. Using a newly developed computer model, forest researchers found that the introduction of air into conducting elements of branches may be an adaptive response to drought. This phenomenon allows the tree to survive by sacrificing some peripheral branches.

- ▼ Silviculturists have discovered that black walnut--highly prized for furniture manufacture--will grow rapidly on marginal soils if interplanted with black alder or autumn-olive. These latter species are noted for their nitrogen fixing, a form of natural soil fertilization. Interplanting these species not only increases the growth rate of black walnut on poor soils but allows this valuable tree to be grown on previously unsuitable lands.
- ▼ Most wood cells result from an undifferentiated layer of tissue called the cambium, so it is a mystery why different pieces of wood of the same species exhibit different properties. Research on wood formation has solved part of the mystery by showing that cell properties are influenced by the time they take to differentiate from the cambium, and this length of time is influenced by the position of the cambium along the stem, and by the season of the year. Such research may ultimately lead to development of techniques for manipulating tree growth to produce wood with specific properties for specific uses.
- ▼ Variations in the horizontal density of flakeboard can diminish its strength in two ways--through tension failure and low internal bonding. Wood utilization research has developed a model to study the modification of horizontal density distribution through simulation. This model will also help scientists learn how resin content and resin distribution affect

the quality and durability of waferboards and oriented strand boards--materials that can utilize forest wastes in construction.

## RESEARCH NATURAL AREAS

The Forest Service established its first natural area in 1927 on the Coronado National Forest in Arizona. It was known as the Santa Catalina Natural Area, but later the designation was changed to **research** natural area, or RNA. Since then, we have established 191 RNA's. We have another 550 on the drawing board.

The Forest Service's RNA's are part of a national network of field ecological areas set aside for research, education, and for maintaining biological diversity on National Forest System lands. Other agencies and organizations have comparable programs, with more than 500 RNA's established in all.

RNA's are pristine examples of representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geological, and similar natural situations having special characteristics of scientific interest and importance. RNA's have been set aside for nonmanipulative research, observation, and study. They serve also:

- ▼ to preserve and maintain genetic diversity,
- ▼ to protect against serious environmental disruptions,
- ▼ as reference areas for the study of succession,
- ▼ as baseline areas for measuring long-term ecological change,
- ▼ as control areas for comparing results from manipulative research, and

- ▼ to monitor effects of resource management techniques and practices on National Forest System lands.

The Forest Service RNA program made its greatest stride in 1988. During 1988, 29 new areas were established--more than in any year since the program began in 1927. In addition, all data about established RNA's have been entered into the Forest Service electronic filing system. We take great pride in the recent additions to the RNA program, and we plan to continue our success in establishing new RNA's in 1989.



# *Resources Planning Act*



## INTRODUCTION

The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, as amended, directs the Secretary of Agriculture to periodically assess the status of the Nation's forest and range resources and to recommend a Forest Service program for their management and use. The Act requires the Agency to develop an Assessment every 10 years and a Recommended Program every 5 years.

The RPA Assessment describes the Nation's renewable resource situation and projects supplies of and demands for these resources. The 1979 RPA Assessment, and its 1984 supplement, were used in preparing the current 1985 RPA Recommended Program. In 1988, a draft of the 1989 RPA Assessment was circulated for technical review. It will be finalized in 1989, and its major findings will be discussed in next year's "Report of the Forest Service." Information in the 1989 RPA Assessment will be used in developing the 1990 RPA Recommended Program.

The 1985 RPA update is the third Recommended Program. It identifies a reasonable range of management directions, outputs, costs, and goals for the long-term. It provides Congress and the public with a valuable information base on which to continue their informed participation in the decisions affecting our national forests.

Work is underway on the 1990 RPA Program, which will result in the fourth Recommended Program. A draft of the 1990 Program is scheduled to be released for public comment in the spring of 1989. Comments will be considered in the preparation of the final 1990 RPA Recommended Program.

To achieve long-term goals over the next 50 years, the RPA Program defines a course of action for Forest Service programs over the next 5 years. Each 5-year update provides for evaluating policies and goals and for incorporating new information, such as costs, bene-

fits, and available management technology. The RPA Program addresses National Forest System management and administration, forestry research, and assistance and leadership on private and State forest lands.

## MAJOR FINDINGS OF THE 1979 RPA ASSESSMENT AND SUPPLEMENT

The 1979 RPA Assessment and its 1984 supplement found that demand for most products in the next 5 decades is likely to continue increasing in response to a 34 percent increase in the Nation's population and a tripling of economic growth. The tabulation below shows the projected percentage increase in total national demand for selected resource outputs:

	Percentage Change from 1980	
	2000	2030
Timber	30	64
Range grazing	35	41
Downhill skiing	78	234
Hiking	17	59
Dispersed camping	33	105
Waterfowl hunting	33	69
Freshwater fishing	39	90

Resource supplies in the years ahead, based on a continuation of recent management trends, also would increase, but not as rapidly as demands at current price levels. As a result, demand and supply will move to a new equilibrium position, with associated effects on the economy, the society, and the environment. Among these are the following:

- ▼ Increasing prices and related consumer costs, particularly for softwood timber.
- ▼ Increased dependence on wood substitutes and imports.
- ▼ Less satisfying outdoor recreation experiences.

- ▼ Increasing environmental protection costs.

These effects will offset some of the benefits that would otherwise evolve from the projected tripling of consumer disposable income.

The RPA Assessment also pointed out that the expected increase in the price of consumer outputs is not inevitable. Expansion of private investments as well as public programs could reduce expected price increases.

## THE RECOMMENDED PROGRAM

The RPA Program is presented as a range of outputs and activities, and its scope is discussed in terms of the High Bound and Low Bound of that range. The High Bound responds immediately to the 1979 RPA Assessment and RPA goals. The Low Bound response to long-term goals is confined to a constant level through 1990 to avoid adding to the Federal deficit.

The fundamental principle emphasized by the President's Statement of Policy in implementing the RPA Program is to strive for a judicious balance among:

- ▼ The needs of this generation and those of future generations.
- ▼ The need for wilderness and the need for timber, forage, and minerals.
- ▼ The need to produce direct economic benefits and the need to provide for other benefits, such as outdoor recreation.
- ▼ The need to invest in national forests and the need to meet other demands on the Federal budget each year.
- ▼ The share of costs paid by general taxpayers and the share paid by specific users.

Major Emphases of the RPA Program are as follows:



- ▼ Restoration and improvement of recreation facilities and trails.
- ▼ Significantly increased timber outputs from National Forest System lands.
- ▼ Improved, more cost-effective management techniques for national forests and other lands.
- ▼ New technologies to enable higher timber outputs while maintaining the environment.
- ▼ Improved coordination and mitigation for threatened and endangered species and completion of recovery schedules by the year 2000.
- ▼ Restoration of key habitat for salmon and steelhead.
- ▼ Shared responsibilities between users and Federal budget expenditures for bearing costs.
- ▼ Increased State and private share of support for State and private forestry.

### National Forest System

The 1985 resource output response to national long-term goals for the National Forest System was developed using the most up-to-date information available from forest planning.

The table below shows long-term program goals (years 2000 and 2030) for the National Forest System at both Bounds as compared to 1986, the first year of the current RPA Program.

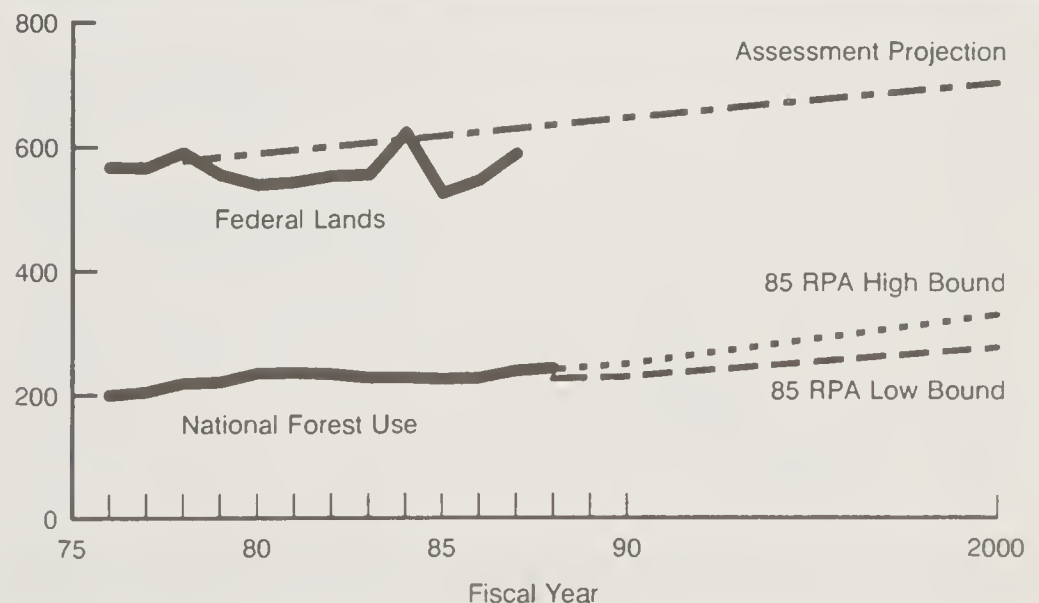
**Minerals.** Workload in the minerals program is expected to grow rapidly in response to minerals demands during the first 5 years of the RPA Program. Processing permit applications will grow more slowly at the Low Bound, postponing some of the potential growth in economic benefits. At the High Bound, resource outputs are 50 percent higher

PROGRAM GOALS FOR THE NATIONAL FOREST SYSTEM

	2000		2030		
	1986 Resource Output	Resource Output	Percent Change from 1986	Resource Output	Percent Change from 1986
<b>LOW BOUND</b>					
Minerals (thousand cases)	24	32	33	36	50
Recreation use (million visitor days)	215	260	21	340	58
Wilderness (million acres)	32	35	9	35	9
Range grazing (million AUM)	9.8	10	2	10.3	5
Timber offered (billion board feet)	11.4	11.8	4	15.6	37
Wildlife & fish (million user days)	23	23	0	28	22
<b>HIGH BOUND</b>					
Minerals (thousand cases)	24	36	50	38	58
Recreation use (million visitor days)	215	310	44	400	86
Wilderness (million acres)	32	38	19	40	25
Range grazing (million AUM)	9.8	10.3	5	11.3	15
Timber offered (billion board feet)	11.4	14	23	20	75
Wildlife & fish (million user days)	23	35	52	40	74

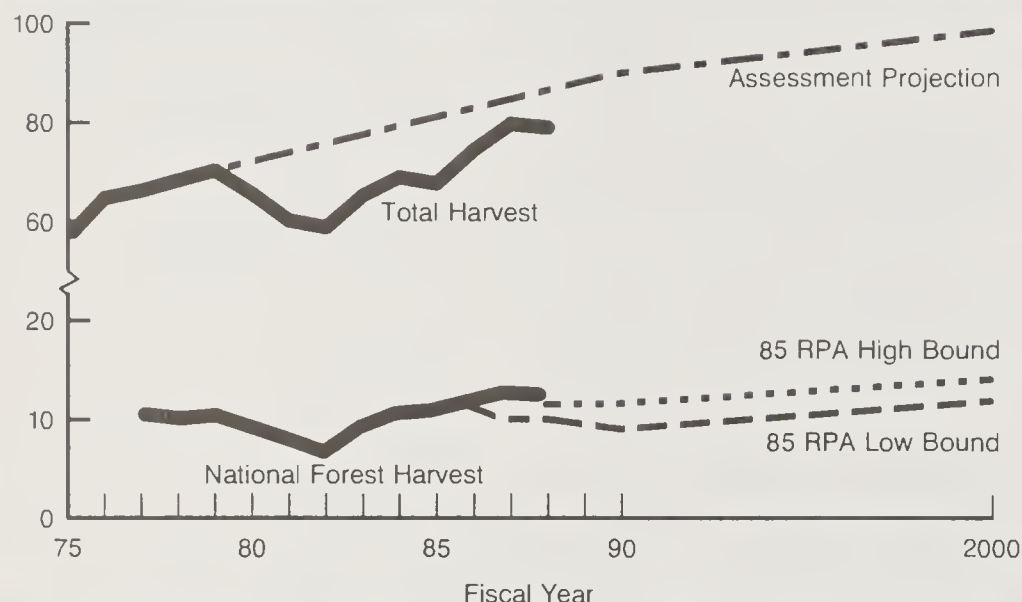
### Recreation Use

Million Recreation Visitor Days (RVDs)



### Timber Demand and Harvest Levels

Billion Board Feet



by the year 2000, with accompanying higher benefits.

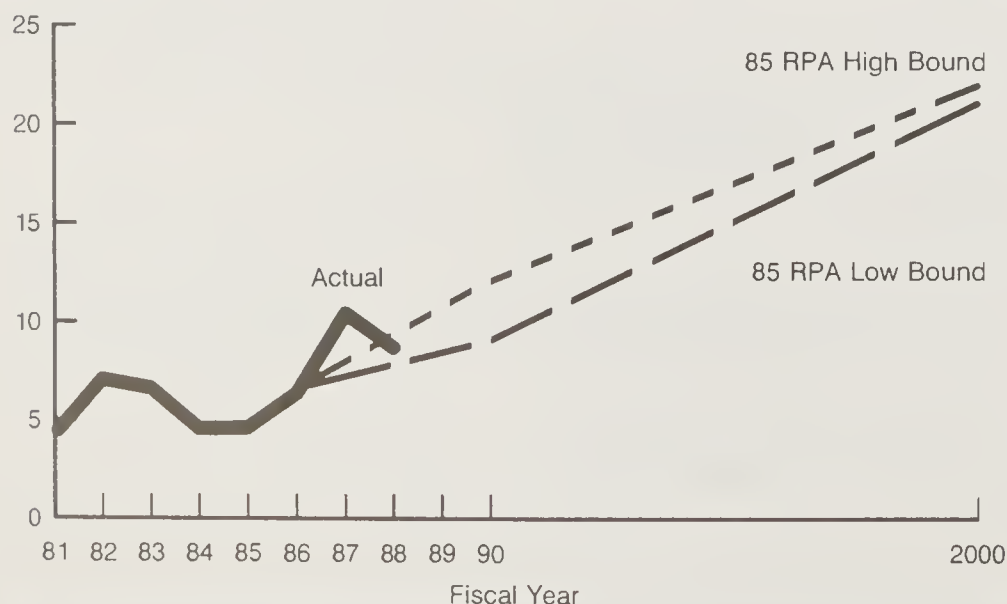
**Recreation.** To meet future goals in the recreation program, the early years of the RPA Program capitalize on other resource management activities and volunteer programs to help meet increasing demands in a cost-effective manner. Emphasis is placed on improving and maintaining existing facilities and trails.

The recreation use graph for Federal lands indicates that about 40 percent of such recreation use occurs on national forest lands. The High Bound of the RPA Program would maintain this share of the 1979 RPA Assessment projection of future use; at the Low Bound, the national forests would be expected to provide about a 7 percent lower share of the total, or 33 percent of total Federal recreation visitor-day use.

The Program projects a 10 to 25 percent increase in wilderness acreage. The primary activities to protect wilderness values are improving the trail system and administering and managing the wilderness system for all wilderness uses.

### Soil and Water Resource Improvement (Appropriated Funds Only)

Thousand Acres



**Range Forage.** Range management emphasizes improving and maintaining resource productivity. This includes maintaining domestic livestock grazing at current levels through the year 2000 while improving conditions for wildlife, watershed, and recreation use. Grazing on National Forest System lands is a small portion of all grazing use in the Nation; however, much of the national forest use is seasonal and complements operations on adjacent private lands. Actual grazing use on National Forest System lands in 1988 was 9.9 million animal unit months, slightly higher than RPA Program recommendations.

**Timber.** Despite higher timber goals in the future, timber harvest would increase only slightly through 1990 at the High Bound and would decline by about 20 percent at the Low Bound. Timber harvest increases at both Bounds after 1990. To meet long-term



goals, the RPA Program relies on new technology to provide additional economic opportunities and cost reduction to raise the efficiency of the program. The higher timber output, with other rising outputs, would contribute to community growth.

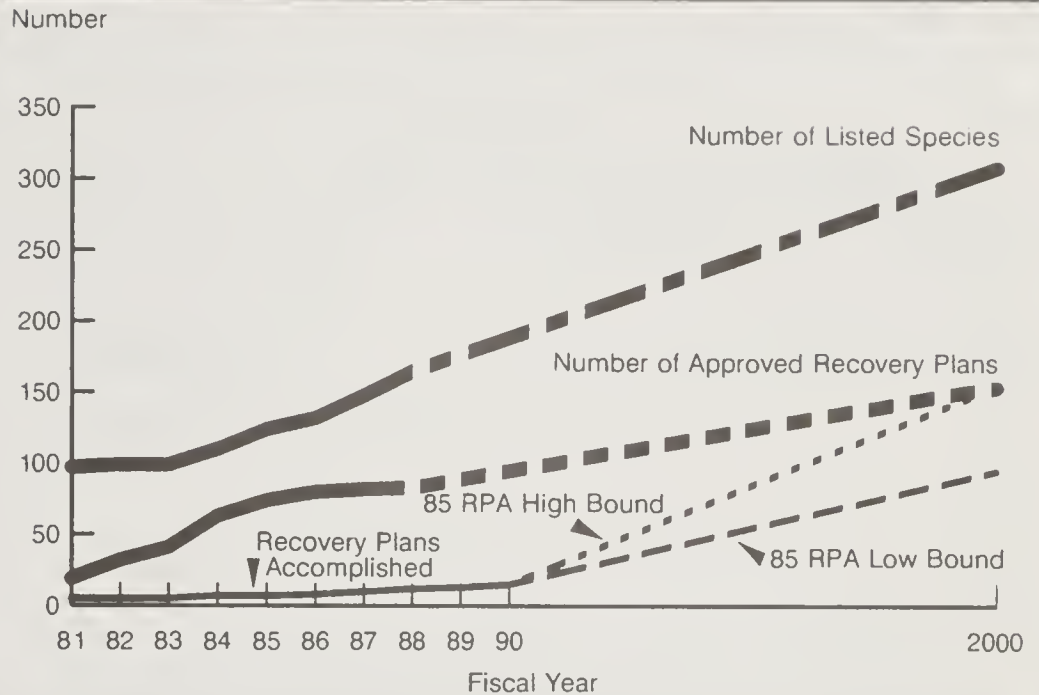
Reforestation and timber stand improvements increase in early years to support harvest levels at the High Bound. At the Low Bound, these activities are held constant through 1990, deferring needed timber stand improvement until after that time.

The timber demand and harvest graph compares U.S. and national forest totals, as well as RPA Assessment projections. During the early 1980's, RPA Assessment projections were high with respect to actual national harvests. Timber harvest from national forests increases at both Bounds by the year 2000. National forest harvest was 12.6 billion board feet, 15 percent of the U.S. total harvest, in 1988. At the High Bound in the year 2000, national forest harvest is 14 percent of the projected U.S. total; at the Low Bound, it is 11.8 percent.

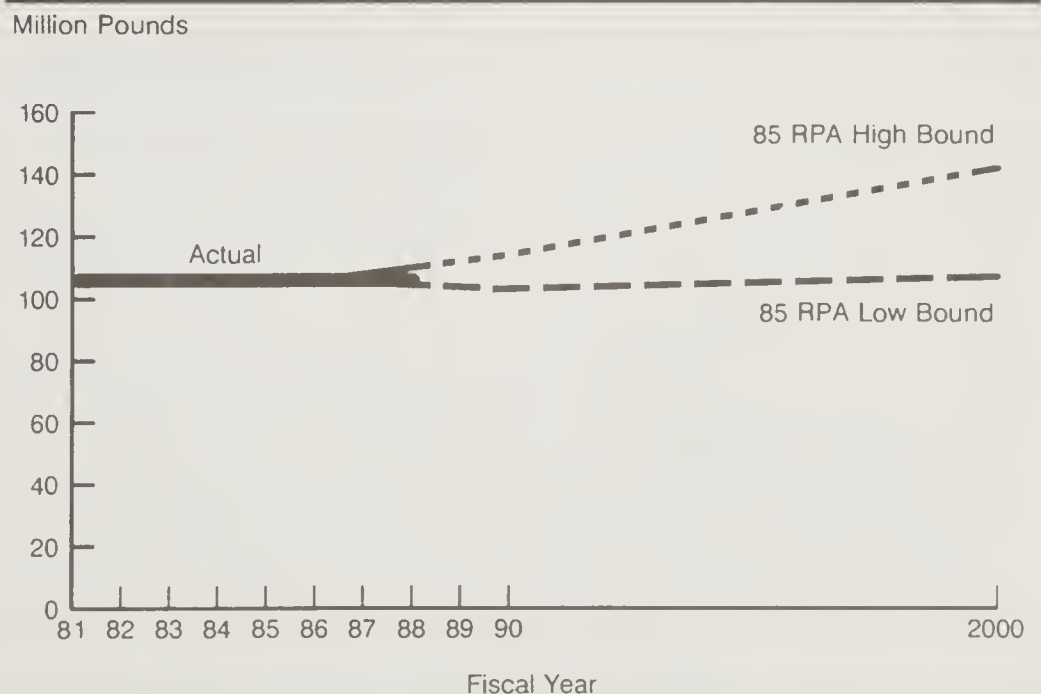
**Water Resources.** The RPA Recommended Program maintains or enhances long-term water supplies and water quality on the national forests. Emphasis is on improving watershed condition and maintaining sensitive riparian areas. The watershed improvement graph shows levels of accomplishment associated with increased investments in the RPA Program. Watershed improvement accomplished with appropriated funds in 1988 was 8,683 acres, slightly above the Low Bound recommendation of 8,200 acres.

**Wildlife and Fish.** The RPA Recommended Program provides for balanced attention to all wildlife and fish habitats to meet long-term goals. The High Bound includes special emphasis to improve habitat for threatened and endangered species and salmon and steelhead by the year 2000.

### Listing and Recovery for Threatened & Endangered Species on National Forest System Lands

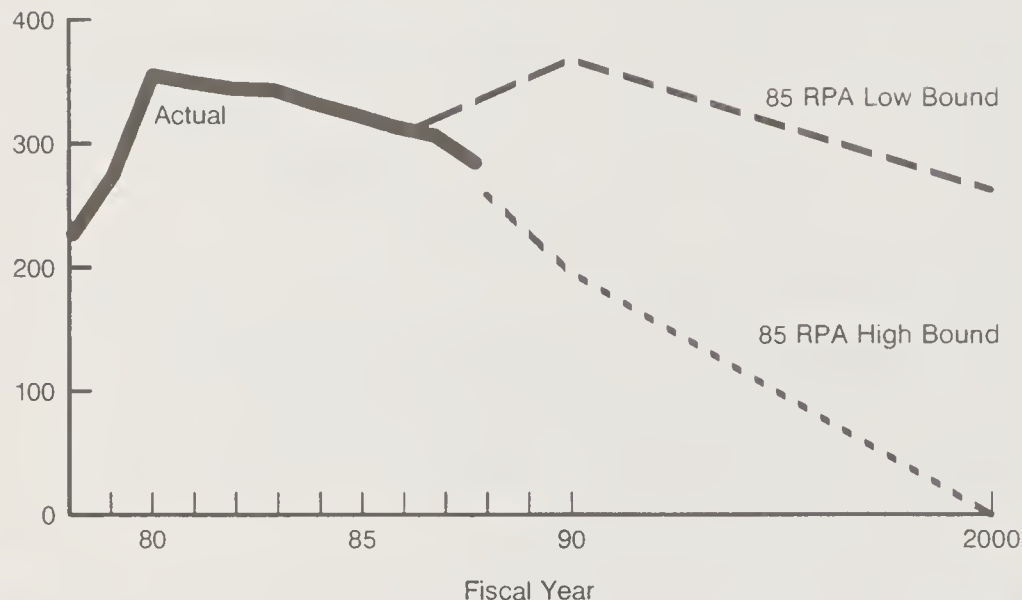


### Salmon & Steelhead Commercial Harvest (Reared and Spawned on National Forests)



### Recreation Facilities Deferred Maintenance Constant 1988 Dollars

Million Dollars

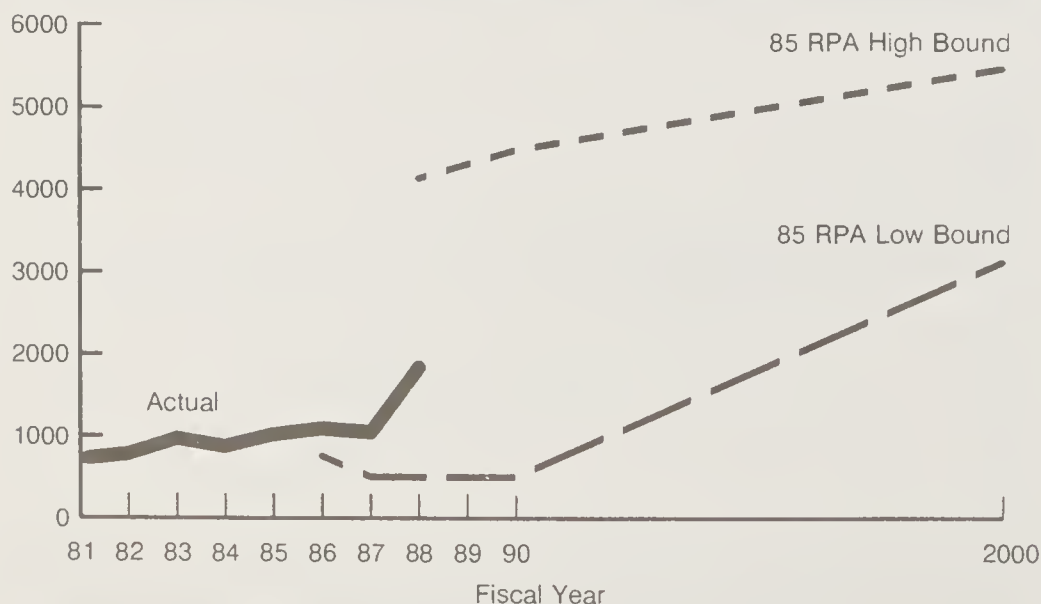


National Forest System lands continue to be essential for maintaining the threatened and endangered species in the United States. By the year 2000, the High Bound would achieve 100 percent of Forest Service recovery tasks identified in U.S. Fish and Wildlife Service approved plans; the Low Bound would achieve 65 percent of those tasks. We will need increased emphasis to close the gaps among the number of species being listed, the number of plans being prepared, and accomplishment of our share of recovery tasks in those plans.

The annual harvest of salmon and steelhead spawned and reared in national forests has averaged about 106 million pounds during the 1980's. The capability exists to increase the harvest through investments in habitat improvement. The High Bound would increase harvest by 33 percent in the year 2000; the Low Bound would not increase harvest until after the year 2000.

### Trail Miles Constructed/Reconstructed RPA and Actual Accomplishments

Miles Accomplished



**Deferred Work.** Recreation use on national forests declined from 1981 through 1986, although recent use has returned to the level of the early 1980's. Approximately 60 percent of recreation use on national forests is for unstructured dispersed recreation. The remaining use is at developed facilities. Over this period, the operating capacity for these facilities on national forests has declined to the current level of 126 million PAOT days (PAOT is the capacity in people at one time). The decline in use during the 1980's in part reflects this lower capacity and a public desire for higher levels of development at these facilities.

Past program levels have resulted in a substantial amount of facility and resource rehabilitation work that needs to be done. The current condition of recreation facilities and trails is a visible example of this situation. Nevertheless, the amount of deferred recreation facility maintenance has been gradually reduced in recent years.



The High Bound eliminates deferred work in these areas by the year 2000. At the Low Bound, deferred needs increase through 1990. After 1990, the Low Bound also reduces the inventory of deferred needs to prevent further resource and facility deterioration.

### State and Private Forestry

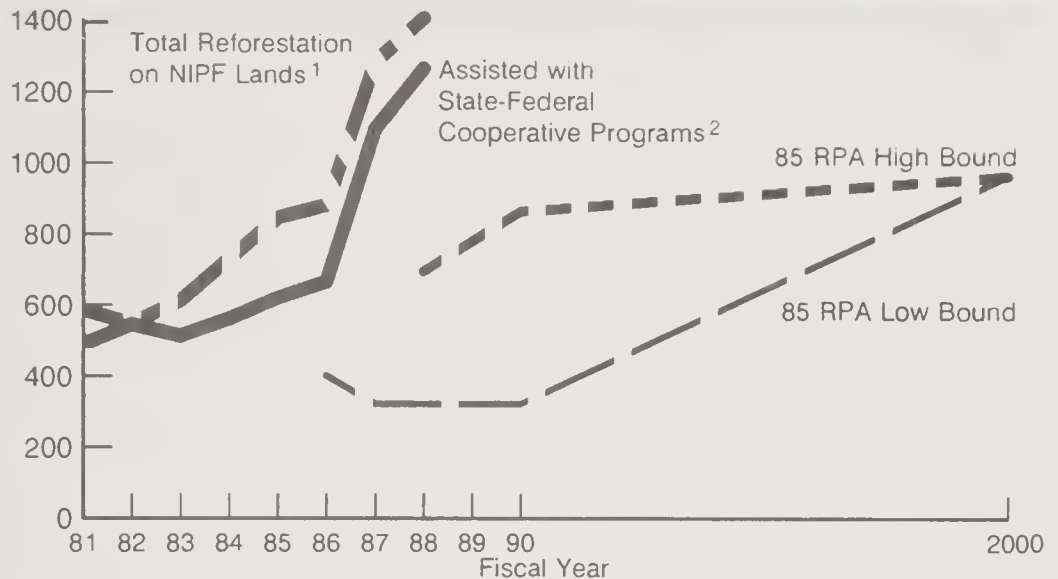
The objective of State and Private Forestry is to increase the productivity of nonindustrial private forest lands to meet projected resource demands at a reasonable price. Of the Nation's commercial forest land, 57 percent is owned by nonindustrial private forest landowners. These lands currently support 46 percent of the Nation's softwood and hardwood growing stock and 38 percent of the Nation's sawtimber inventory. Because there is relatively little forest management on about two-thirds of these lands, they offer the greatest opportunity for increasing timber supplies in the United States. These opportunities are located largely on 10 percent of the ownerships with more than 100 acres of land.

The RPA Program relies on the States and the private sector to provide an increasing share of the cost over time at both the High Bound and Low Bound. Expected outputs are the same at both Bounds after the year 2000, but the Federal presence is different. Both Bounds would require the States to decide whether to replace Federal financial assistance with State-level assistance. The High Bound of the Program assumes States will gradually replace Federal financial assistance, and this will be accomplished by the year 2000. At the Low Bound, Federal financial assistance is discontinued after 1986.

For the sixth consecutive year, the Nation has broken all previous records for planting trees on nonindustrial private lands. Approximately 41 percent of the trees planted in 1988 (1.4 million acres) were on nonindustrial private forest lands, primarily in the South.

### Total Reforestation on Nonindustrial Private Forest (NIPF) Lands

Thousand Acres



<sup>1</sup> Total reforestation on NIPF lands includes acreage from state incentives programs, landowner assistance by industry, consultants, and unassisted owners in addition to acreage assisted with State-Federal cooperative (S&PF) programs. Accomplishment shown for FY 1987 and 1988 includes Conservation Reserve planting.

<sup>2</sup> The portion of reforestation assisted by State-Federal cooperative programs - FIP and ACP (ASCS programs jointly administered by the Forest Service) and Conservation Reserve (administered by ASCS with Forest Service and Soil Conservation Service assistance) which cost share planting with landowners and non-cost share planting, i.e. provide technical assistance only.

The State and Private Forestry reforestation programs described in the 1985 RPA Program provide assistance in reforestation on nonindustrial private forest lands. In 1982, State-Federal cooperative programs, which include both State and Federal costs, assisted in almost all the 548,000 acres of reforestation on nonindustrial private forest lands; in 1986, they reforested 667,000 acres, or 75 percent of the total.

The chart shows this accomplishment as compared to the RPA Program. The increase from 1981 through 1986 occurred with stable funding of the Forestry Incentives Program and Agricultural Conservation Program, which provide cost-share assistance to landowners. The increase also reflects a trend of the States and landowners to provide an increasing share of the cost. Although reforestation under these two programs is included in the RPA, the programs are funded through the

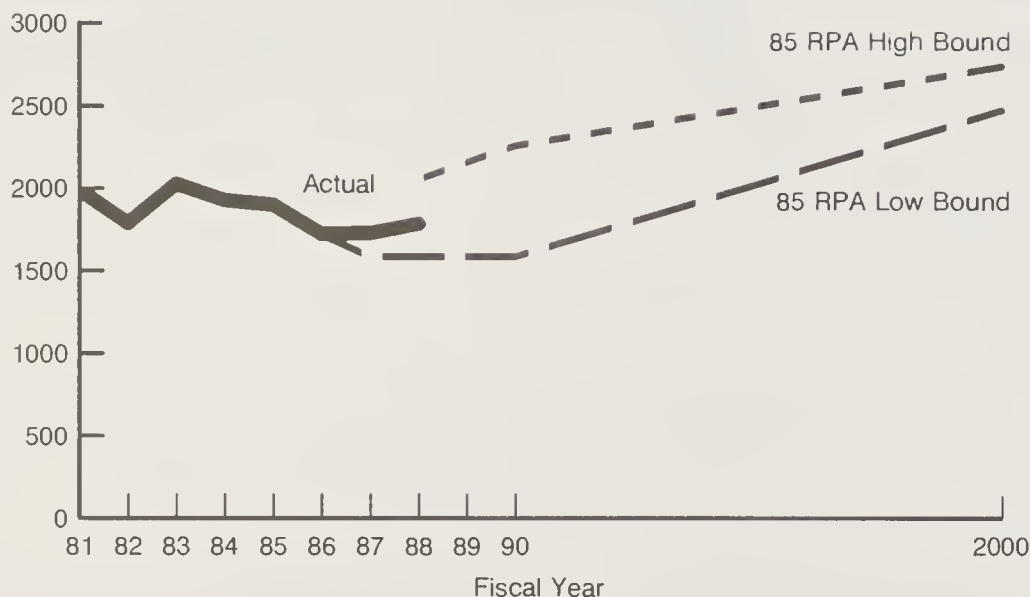
Agricultural Stabilization and Conservation Service, and their costs are not included in the State and Private Forestry costs.

The primary reason for the sharp increase in fiscal year 1987 and 1988 planting was the Conservation Reserve Program, established as part of the Food Security Act of 1985. Congress established a goal of 5 million acres for tree planting under this program by 1990. This will result in a short-term increase in acres planted, similar to the Soil Bank Program in the late 1950's. After 1990, tree-planting accomplishments are expected to drop back to the pre-1987 trend. Including Conservation Reserve Program planting, State-Federal cooperative programs accounted for about 80 percent of total reforestation on nonindustrial private land in 1988.

## RPA Program

National Forest System  
Constant 1988 Dollars

Million Dollars

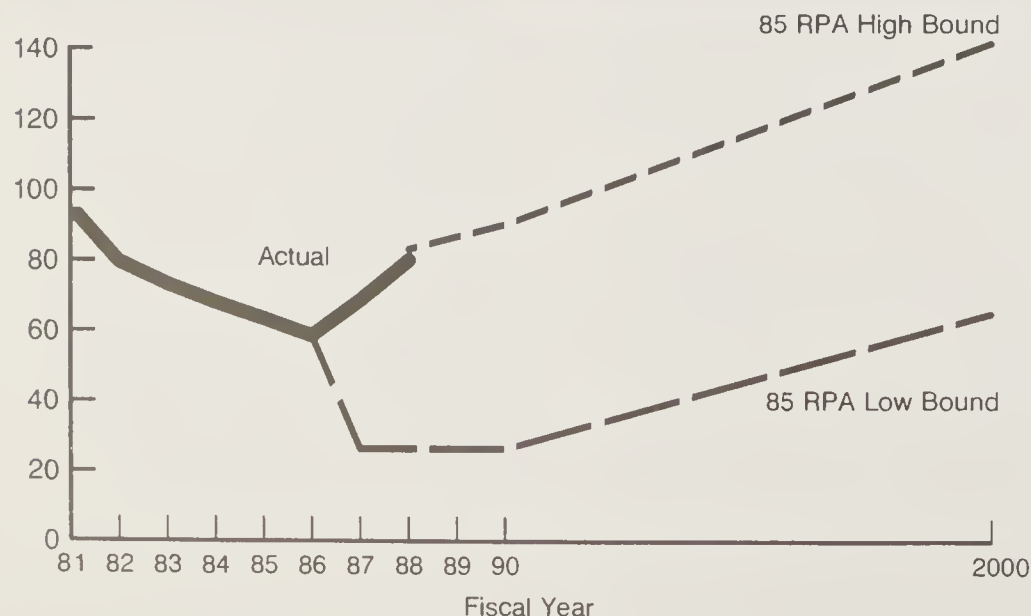


The 1985 RPA Program is the same as the actual Forest Service budget in 1986 and is the same as the President's budget proposal for 1987. Beginning in 1988, the Program is expressed as High and Low Bounds of a range.

## RPA Program

State and Private Forestry  
1988 Dollars

Million Dollars



The 1985 RPA Program is the same as the actual Forest Service budget in 1986 and is the same as the President's budget proposal for 1987. Beginning in 1988, the Program is expressed as High and Low Bounds of a range.

## Research

The research goal is to improve long-term productivity on public and private lands and to provide basic technology to cope with emerging problems. A primary focus of the RPA Program for research is to support cost-efficient management of National Forest System lands. The ability to meet planned output levels is directly related to early investments in research.

The Research program has two major components: (1) the base level, and (2) additional research initiatives. A substantial portion of the base program is aimed at sustaining technological effectiveness. Other research in the base program is classified as enhancing research--research to increase technological capability and effectiveness.

To satisfy the additional needs identified for managing and assisting the Forest Service and other Federal, State, and private sector users of Forest Service research, we would need a program above 1986 funding levels for high priority initiatives in such areas as biotechnology and acid deposition. The most distinct differences between the High Bound and the Low Bound are the rates of implementation of currently identified initiatives and some reordering of priorities among initiatives. At the High Bound, research on most of the initiatives would be under way by the year 2000; at the Low Bound, this level of research would not be reached until 2030.

In 1988, the Research Program budget was \$135.5 million. This was above the High Bound recommended level. Research emphasis now being placed on acid deposition, biotechnology and threatened and endangered species is greater than was anticipated in the RPA Recommended Program.

## Total Program

The accompanying graphs show the actual Forest Service program for 1981 through 1988 for National Forest

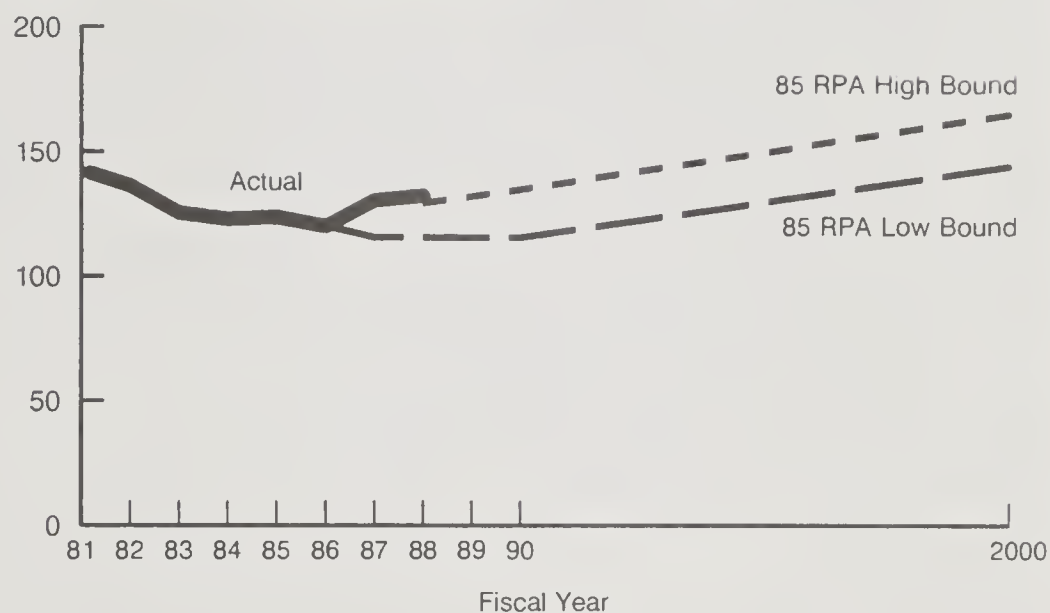


System management and administration, Forest Service Research, and State and Private Forestry assistance and leadership. The graphs also show the level of program through the year 2000 that would move toward the long-term goals and outputs.

### RPA Program

Research  
1988 Dollars

Million Dollars



The 1985 RPA Program is the same as the actual Forest Service budget in 1986 and is the same as the President's budget proposal for 1987. Beginning in 1988, the Program is expressed as High and Low Bounds of a range.



Photo by Ken Hammond



# Administration



## INTRODUCTION

The job of Administration is to manage the Forest Service's organizational resources in the most efficient and effective manner to achieve the Agency's mission. As budgeted resources continue to become more limited and land management issues become more complex, 1988 Administration efforts focused on further improving Agency productivity; better managing the human, capital, and information resources; and maintaining an information and involvement emphasis for the American public with regard to forest management.

## IMPROVING AGENCY PRODUCTIVITY

### Management Improvement

**Pilot Study.** The Forest Service has tried all the traditional ways to cut cost and improve productivity but they all failed to completely free the human spirit to seek even higher levels of productivity. To experiment with freeing the human spirit, in 1985 we initiated the National Pilot Study, in which we designated three national forests and a research station to test a less stringent control structure that encouraged innovation and creativity. The units were granted:

- ▼ Flexibility within basic policy and legal bounds to achieve agreed-on output targets and objectives, including waivers from certain requirements.
- ▼ Budgets allocated by appropriation rather than numerous line items.
- ▼ A process whereby ideas for productive change are generated from the bottom of the organization upward and are approved if legal and worth testing.
- ▼ Freedom to apply savings to other high-priority work.

Based on the success of the pilot study in 1986, we expanded it in 1987 to include an entire region and another research station. In addition, some Regional Foresters initiated "pilot type" efforts within the scope of their own authorities. In early fiscal year 1988, the pilot study was expanded again to include the Washington Office of the Forest Service.

While continuing to test new and innovative ideas on the national pilot test units, the evaluation phase has been initiated. Many new approaches or procedures (particularly in administrative functions) have been tested for 2 to 3 years, and study results are available. Once ideas have been adequately tested, they will be evaluated and a decision will be made as to whether or not to implement them Service-wide.

As the pilot test continues, the Forest Service is learning about how to motivate workers and increase productivity in a government setting. New ideas that challenge traditional approaches to structuring and operating government organizations are evolving. We are developing a series of provocative papers, entitled "New Thinking for Managing Government," to document the pilot test experience and share the results with other government agencies.

**USDA Demonstration Project.** The U.S. Department of Agriculture received approval from the Office of Personnel Management to develop a demonstration project that would evaluate alternative procedures for recruitment, selection, and retention with possible Federal-wide application. The Forest Service and Agricultural Research Service will participate in this major project. It should reduce hiring paperwork and improve the ability to acquire a quality work force that reflects a culturally diverse society.

**Agency-Provided Medical Care.** During the high fire season this past year, the Forest Service initiated the Agency-Provided Medical Care plan for

several large fires. Total savings have not been determined, but over 85 percent of firefighter injuries can be treated by the plan. We believe that this endeavor will decrease Office of Workers' Compensation Program claim cases, reduce the amount of medical care, expedite payments to providers, and improve service to employees.

### Business Management Automation

As part of our continuing productivity-improvement efforts, the Forest Service has significantly enhanced its major automated systems this year. The Agriculture Contract Automation System is in place in most Agency offices, allowing for the preparation of procurement contract packages on the Service-wide computer network. The Automated Purchase Order System is operational and available to 140 units, capable of developing requisitions and purchase orders and electronically transmitting the orders to the USDA National Finance Center in New Orleans.

We completed implementing the electronic personal property management system this past year. The system allows on-line access to the Department's electronic inventory system, the Property Management Information System at The National Finance Center. It also provides electronic access to Department of Agriculture and General Services Administration data banks for screening excess Government property. In addition, we have developed a system to electronically interact with the property system to automatically input inventory data on newly acquired personal property.

The Agency continued full implementation of the Electronic Time and Attendance System, the Personnel Information Management System, and the Position Management System. These systems save more than \$3 million annually, reduce error rates, and require less personnel to operate.



## MANAGING THE HUMAN RESOURCE

### Work Force Population

The Forest Service had 28,800 permanent full-time employees in 1988, with total employment by the end of the fiscal year of more than 45,000 (including emergency, regular temporary, excepted, and so forth). This is a 7 percent increase over 1987. The increase is attributed to the need for more personnel to suppress the large amount of wildfires that occurred in the West.

Technical positions made up more than half the total work force, and professional, clerical, and administrative employees made up the remainder.

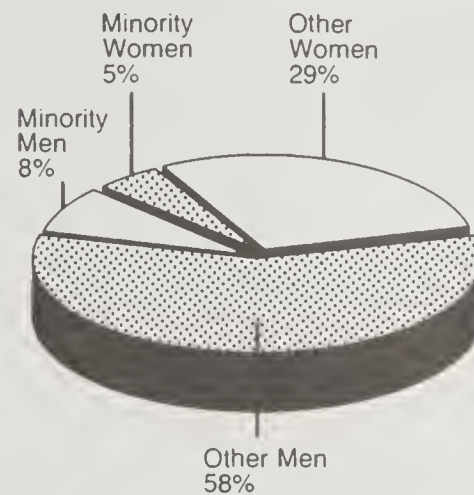
To improve efficiency in hiring temporary employees, the Forest Service continued the trial program to use State employment offices to fill summer/seasonal vacancies on selected national forests. Because of the success of the trial program, the Agency plans to implement this process Service-wide in 1989. We anticipate that relationships with State employment offices will improve, and we will also save the Agency approximately \$1 million annually.

### Diversity

The Agency continued increasing its representation of women and minorities. Women constituted 34 percent and minorities made up 13 percent of the permanent work force. Together, women and minorities occupied 22 percent of professional, 40 percent of technical, and 66 percent of administrative positions. The Agency continued special efforts to advance women and minorities into key management positions. The Forest Service now has more minorities and women in Director, Forest Supervisor, Deputy Forest Supervisor, and District Ranger positions than at any time in its history.

The Chief of the Forest Service is chairing a high level, Department of Agriculture-wide, 10-member task force to improve relations between the

### 1988 Permanent Workforce Composition



Department and Historically Black Colleges and Universities. The Forest Service has taken positive steps to implement the task force recommendations.

Work Force 1995 was initiated to meet the objective of a more diversified work force by concentrating on five areas: recruitment, retention, upward movement, organizational culture, and public awareness along with internal understanding.

The Agency sponsored a Native American-Alaskan Native Study to increase emphasis and awareness of Native American issues. As a result, the Chief approved policy to improve relations with external organizations such as Reservations and schools, and to meet employment concerns of Native American and Alaskan employees.

### Special Programs

The Forest Service's Human Resource Programs provide job opportunities and training for youths, the unemployed, underemployed, economically disadvantaged, and elderly while carrying out high-priority conservation work. These programs are the Job Corps, Senior

Community Service Employment Program, Youth Conservation Corps, Volunteers in the National Forests, and Hosted Programs.

These programs offered employment and skills training to 91,244 persons during 1988, including many women and minorities. For an investment of \$82.9 million, a value of \$91.9 million in accomplishments was returned from all programs (table 63). Participants built campgrounds and trails, planted trees, built fences, fought fires, improved timber stands, constructed office buildings, warehouses, and roads, and provided clerical support.

**Job Corps.** Under an interagency agreement with the U.S. Department of Labor, the Forest Service continued to operate 18 Job Corps Civilian Conservation Centers on 15 national forests in 11 States. The focus remained on improving the enrollees' opportunities for productive work through training in vocational skills, basic education, and attitudinal development. More than 89 percent of the graduates were placed in jobs, returned to school, or joined the military.

The 18 Forest Service Centers served more than 9,000 disadvantaged youths who are between the ages of 16 and 22. These centers accomplished improvements valued at \$19.2 million, including firefighting, community work, building construction disease control, and reforestation work. Enrollee records were automated by adding corpsmembers' records to the Forest Service Distributed Processing Computer system.

During the past year, the Job Corps program made strides in its effort to increase opportunities to train women enrollees. The Forest Service increased the number of coeducational centers to 9 and laid plans to make the remaining centers coeducational in the near future.

The Forest Service signed a partnership agreement with the Staff Development Center of the Howard County school district in Maryland to upgrade the skills



*A Job Corps member learns techniques for masonry at the Anaconda Job Corps Center in Montana. Photo by Ed Fox*

of its teaching corps. This will ensure that state-of-the-art instructional devices and strategies will be offered to Job Corps instructors.

Finally, our efforts continued to strengthen the Job Corps international ties through contacts with Scotland, Ireland, Canada, and the country of Botswana in Africa.

#### **Senior Community Service**

**Employment Program.** Authorized under the Older Americans Act and funded by the U.S. Department of Labor through an interagency agreement, the Senior Community Service Employment Program provides part-time community service employment for persons with low-income who are 55 or older. The program also provides training opportunities to upgrade present skills and introduce new skills that may result in employment in the private or public sector.



*Senior enrollee uses a dado to cut wood for a Forest Service sign on the Colville National Forest in Washington. Photo by Ed Fox*

The Forest Service successfully placed 16 percent of its participants in jobs outside the Agency during program year 1987-88. More than 6,200 persons participated and accomplished \$33.7 million worth of conservation work. For each appropriated dollar, \$1.48 was returned in value of work accomplished.

**Youth Conservation Corps.** Enrollees in the Youth Conservation Corps are selected randomly from applications submitted by youths who are 15 through 18 years old and who are from all strata of society. The youths earn and learn while performing high-priority conservation work on National Forest System land. This is a summer employment program for 8 weeks, 40 hours per week. The enrollees are paid from Forest Service funds and accomplish a variety of assigned targets. Their work returned \$1.22 for each dollar invested.

#### **Volunteers in the National Forests.**

The volunteers program offers individuals from all walks of life the opportunity to donate their talents and services to help manage the Nation's natural resources. This program continues to grow in popularity as people realize how they can personally help carry out natural resource programs. In 1988, 65,060 volunteers, helped the Forest Service manage National Forest System lands. They also contributed 1,918 person-years of work valued at approximately \$25.5 million.

The Forest Service has maintained a cooperative agreement with North Carolina Agricultural and Technical State University to increase the number of minorities and women who participate in the volunteers program and who pursue careers in natural resources. A dual-degree program in forestry and a course in volunteer management have been developed, and there has been an increase in the number of freshmen entering the natural resource curriculums at the university.

The Touch America Project is a continuing special volunteer program that gives young people between the ages of 14





*Youth Conservation Corps members survey a site for a proposed picnic area for disabled visitors on the Uinta National Forest in Utah.* Photo by Ed Fox

and 17 a chance to gain job experience and environmental awareness while working on public lands. In 1988, private sector organizations sponsored 4,190 youths in the Touch America Project.

**Hosted Programs.** Conservation work opportunities were provided participants in programs administered primarily by State and local governments. Through the use of Hosted Programs, the Forest Service helps alleviate social problems by providing work sites for participants/clients funded through such sources as State health and welfare agencies, the Job Training Partnership Act, State block grants, Vocation Rehabilitation, College Work Study, and other programs and organizations. Legislation for these programs varies, but it usually requires that we provide work experience and training. At the same time, this provides an opportunity for many citizens to become aware of



*Preparing for forest visitors, a campground Host takes care of fee envelopes at a campground on the Medicine Bow National Forest in Wyoming.* Photo by Ed Fox



*TAP young adults construct a trail and scenic overlook for the Copper Creek Falls trail by the Copper Creek Campground on the Idaho Panhandle National Forest.* Photo by Ed Fox



and contribute to caring for natural resources and the environment.

By entering into agreements with State and county agencies, colleges, universities, Indian tribes, private and nonprofit organizations with such multiple objectives as handicapped rehabilitation and advocacy for elderly or at-risk youths, many workers perform natural-resource-related work at little or no direct cost to the Forest Service. In partnership with the U.S. Department of Justice, Bureau of Prisons, the Forest Service explored the possibility of using existing facilities for housing minimum security inmates and having them perform natural-resource-related work on National Forest System lands to assist in alleviating the problem of prison overcrowding.

Participants in Hosted Programs contributed 808 person years of work valued at \$9.9 million. In addition, these programs continue to provide a pool of

potential employees who will contribute to the diversity of our work force.

## MANAGING THE CAPITAL RESOURCE

### Financial Management

The Forest Service made major improvements in financial management in 1988. The accounting code structure changes allowed managers to account for funds by the activity of work being performed. This facilitates the charged-as-worked process resulting in better unit cost information. Using the distributive processing system for transmission of accounting/payment/collection information to and from the national forest units greatly reduced the time required to obtain critical accounting reports necessary for financial and other management decisions. It also reduced costs by eliminating a huge volume of

paper correspondence with the National Finance Center. The new multi-year relational data base of accounting information allowed the use of Forest Service computers to develop various ad hoc financial management reports and to perform cost analysis previously available only through manual processes, thus providing better information at less cost.

The past year was the first for full operation of the Timber Sale Program Information Reporting System (TSPIRS). Because TSPIRS is the first step toward establishing cost accounting for all resource programs, the Forest Service made it part of the Central Accounting System at the National Finance Center. TSPIRS is an accrual accounting system that uses a relational data base which produces the official timber cost-accounting reports, and Forest Service users can access it for analysis by applying the same software used for standard accounting information. This data base will be linked to various timber and road data bases residing at the National Computer Center in Fort Collins, Colorado, and it will be part of a multiyear relational data base repository of timber and road information.

Building on the success of TSPIRS, in fiscal year 1988 the Forest Service completed negotiations with the General Accounting Office to jointly begin development of an accrual cost-accounting system for all resources. Efforts to officially implement the system will be under way in fiscal year 1989, with full implementation planned for fiscal year 1990.

During 1988 we successfully completed using the Central Accounting System to provide accounting data to the Road Analysis and Display System (ROADS). ROADS was implemented in fiscal year 1987 and provides valuable information for managers to monitor the efficiency of the road program on a national, regional, and forest basis.



Workers in the JTPA learn to erect a signpost on the Uinta National Forest in Utah.  
Photo by Ed Fox



## Receipts and Expenditures

Although the Forest Service receives its operating funds from Congress and various cooperator deposits, it also produces revenues. In 1988, we produced 60 cents of revenue for every dollar expended. Our 1988 receipts totaled \$1.62 billion, up 11 percent from 1987, while expenditures totaled \$2.69 billion, up 14 percent from last year.

We collect receipts primarily from timber sales, mineral leases and permits, grazing permits, and recreation uses. Timber receipts in the form of cash, deposits, and roads in lieu of cash totaled \$1.31 billion, or 81 percent of the total revenue in 1988. Receipts from mineral leases, royalties, sales, and bonus bids made up the second-largest revenue source with \$180 million, or 11 percent of the total.

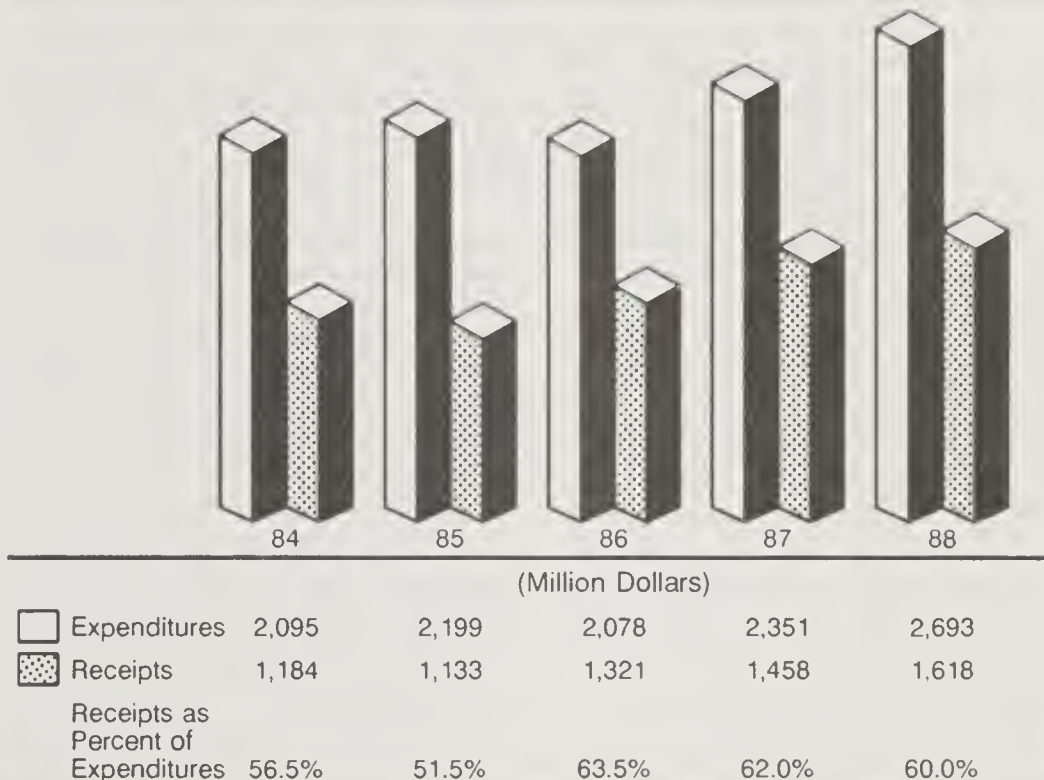
By law, the Forest Service pays the States 25 percent of all national forest receipts. These payments are used for public schools and roads in the counties that have National Forest System lands. We paid \$293.3 million to the States in fiscal year 1988 and \$11 million to counties from National Grassland and Land Utilization Project receipts. Minnesota received \$716,149 under the Boundary Waters Canoe Area Wilderness Act. Table 55 lists additional Forest Service receipt and expenditure data for 1988.

## Procurement and Property

The Forest Service continued to increase the efficiency and effectiveness of the procurement program through which we accomplish much of our land management work and service to the public.

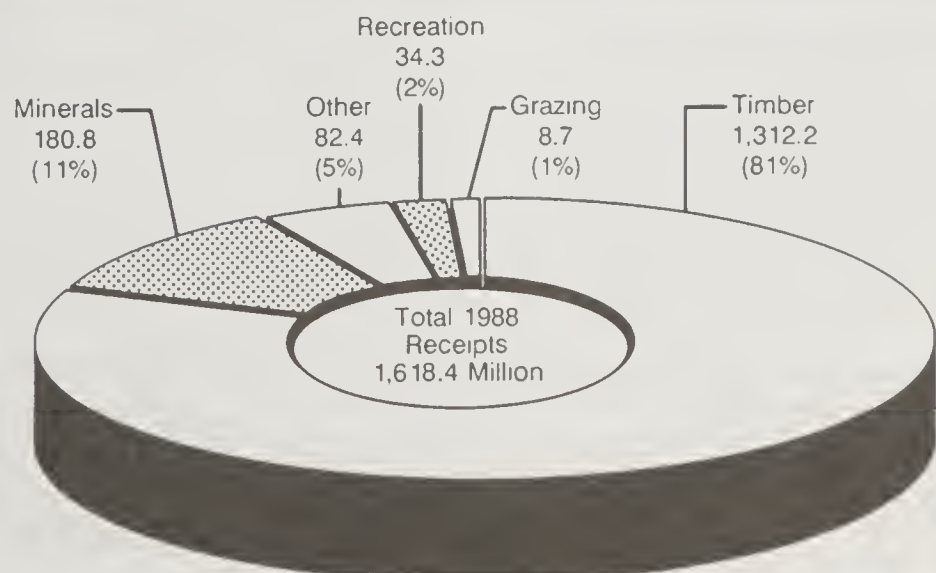
We spent approximately \$650 million, or about 26 percent of the budget, on more than 3,300 new contracts and more than 559,000 separate small purchase transactions during fiscal year 1988. This is a 12 percent increase over 1987 procurement expenditures. Contract awards included \$20 million to businesses that are certified as disadvantaged by

## Expenditures and Receipts



## Distribution of Receipts by Program

(Million Dollars)



the Small Business Administration, \$23 million to women-owned firms, and \$15 million to all other minority firms.

Forest Service personnel managed the leasing of approximately 16 million square feet of space, including buildings owned and leased by the Agency and space controlled by the General Services Administration. We also managed the acquisition, use, and disposal of personal property worth more than \$700 million, including property on loan to State forestry departments. During fiscal year 1988, as in 1987, high forest fire activity in the western states again challenged Forest Service procurement personnel to provide an extraordinary level of support to fire suppression and rehabilitation efforts while continuing to meet ongoing program needs. Fire support contracts provided for the transportation, housing, and feeding of firefighters, as well as suppression equipment requirements. Obtaining the necessary goods and services at reasonable prices in the demanding fire environment and helping to manage the acquired resources are continuing challenges.

## MANAGING THE INFORMATION RESOURCE

### Information Structure

The Forest Service is an information-based organization. We have information about our land resources, such as trees, wildlife, and minerals; and other resources, such as people, dollars, and physical objects the Agency owns or manages. Collectively, this is our information resource and, like other resources, it needs to be managed.

As a continuing effort to carry out information management within the organization, the Forest Service Information Management System has five major components, as described below.

**Information.** In the Forest Service, the information component includes both

basic and interpreted data about resources, people, dollars, and such items as facilities and equipment. Not all information is corporate or shared; some may be needed only for a specific project or staff. It is critical, in any case, that the need for and value of the information be assessed.

As we define what is needed to help make most of our decisions, we need to be able to display it where Forest Service employees can find it, study it, and make daily use of it. We will develop a Management Information Atlas, which will be a single directory for all of our information needs.

**Technology.** Effective information management requires corporate technology--that which is linked throughout the organization and can be used by most of its people. The Forest Service has linked its technology because of prior distribution of computers in more than 800 locations. This distributed network allows information to be sent electronically to employees where terminals are located--in 45 States, the Virgin Islands, and Puerto Rico.

**Process.** Process allows us to aggregate, analyze, interpret, and display information. As with the information and technology components, process will be corporate in nature and it needs to be standard throughout the organization.

An example of a corporate process under development is our national Geographic Information System (GIS) which is a tool to help facilitate the storage, retrieval, analysis, and presentation of spatially related information on topographic features, boundaries, facilities, and resources. A GIS allows information that is referenced to a ground location--soil type, elevation, buildings--to be monitored, analyzed, and graphically displayed.

A GIS is a good example of how a corporate process, combined with corporate information and technology, will allow the Agency to use its knowledge more wisely--that is, improve its information management capabilities.

**Organization.** The fourth component of information management focuses on how people are organized to carry out



*A GIS is a good example of how a corporate process, combined with corporate information and technology, will allow the Agency to use its knowledge more wisely—that is, improve its information management capabilities.* Photo by Yuen-Gi Yee



an effective information management plan. With the corporate theme approach, many of the traditional barriers associated with functional organization can be avoided.

**Roles.** Every employee has a role to play in information management; this component describes the specific roles. Perhaps the most important role belongs to the employee who strives for ways to streamline the collection, upkeep, and management of data needed on a daily basis. Therefore, for information management to become institutionalized, it must become part of everyone's work. The Forest Service Information Management System provides a framework to institutionalize information management through efficient work planning. We have begun to manage the information resource and will continue to encourage all employees to incorporate information management into their daily jobs.

### Distributed Processing

The Forest Service is well into the fifth year of use of its distributed processing network. All offices are now supported with common word-processing, data-processing, and telecommunications capabilities. An outside consulting firm has completed a 4-year study of our use of distributed processing and reported an impressive overall benefit-to-cost ratio of 5 to 1 for the expected 8-year life of the system. The last year of the study shows that 62 percent of the reported benefits are direct cost savings. The remaining 38 percent of the reported benefits have resulted from time saved, which has allowed employees to turn more attention and time to resource management, better organizational management, and more contact with the public.

The 1989 fiscal year will bring increased emphasis on improving the data and information management capabilities within the distributed processing network. New data management tools will be brought into production. An increased effort will also be made to

more closely link micro computers with the existing distributed processing network.

### INVOLVING THE AMERICAN PUBLIC

The Forest Service's public affairs programs were focused on two major activities during fiscal year 1988—one of the worst fire seasons in memory and the continuing effort to develop Forest Land and Resource Management Plans for each national forest.

The 1988 fire season was one of the year's major news stories, taking on added drama with the involvement of well-known areas in and around Yellowstone National Park. Along with firefighters, public affairs personnel were mobilized to feed the insatiable media and public appetite with news of the holocausts. Forest Service spokespersons, including the Chief, appeared on several national television network news shows, and scores of interviews were reported by all media as fire reigned for several weeks as the nation's top story. The high level of interest served to allow the public, as well as private-sector companies and organizations, to become partners in the massive and expensive job of rehabilitating burned areas. Although no figures are yet available, proposals for both volunteers and money have been made by many individuals, companies, and organizations. In a similar effort in California after the 1987 fires, more than \$1.5 million was contributed by the public in that State alone.

Public participation in Federal forest programs continues to help us work towards reaching consensus on the future use and management of each of the 156 national forests. Public participation is one of the critical elements guiding development of Forest Land and Resource Management Plans. Because of the broad spectrum of interests, the process has progressed slower than originally anticipated. As approved forest plans are implemented, we will be actively soliciting more public involve-

ment in project decisions and monitoring the effects of those projects. The reservoir of information gathered in creating the plans is already being used as the foundation for the 1990 Resources Planning Act (RPA) program. It, too, will include intensive public involvement.

The History Section published "The Wilderness Movement and the National Forests: 1980-1984," along with several other documents. Audio-visual specialists worked closely with private contractors, Department of Agriculture employees, and other cooperators to produce a variety of informational products. Public Affairs also prepared a package of informational items to clarify the road development program in the national forests, one of the most popular issues addressed by the public in RPA and forest plans.

The continued growth of public interest in environmental matters was also reflected by two other public affairs projects during the year. The Woodsy Owl Environment Improvement Program continued to grow, as its educational and promotional materials sales reached a quarter of a million dollars, and 3 million pieces of promotional material were distributed.

A second indicator of increased environmental interest was a Fall Color Hotline, which was tested for the first time. By making a paid call to national headquarters, callers could hear a recording describing the status of fall foliage in national forests in different parts of the country, including driving routes for the best fall color. In a 4-week period, approximately 2,500 calls were received.



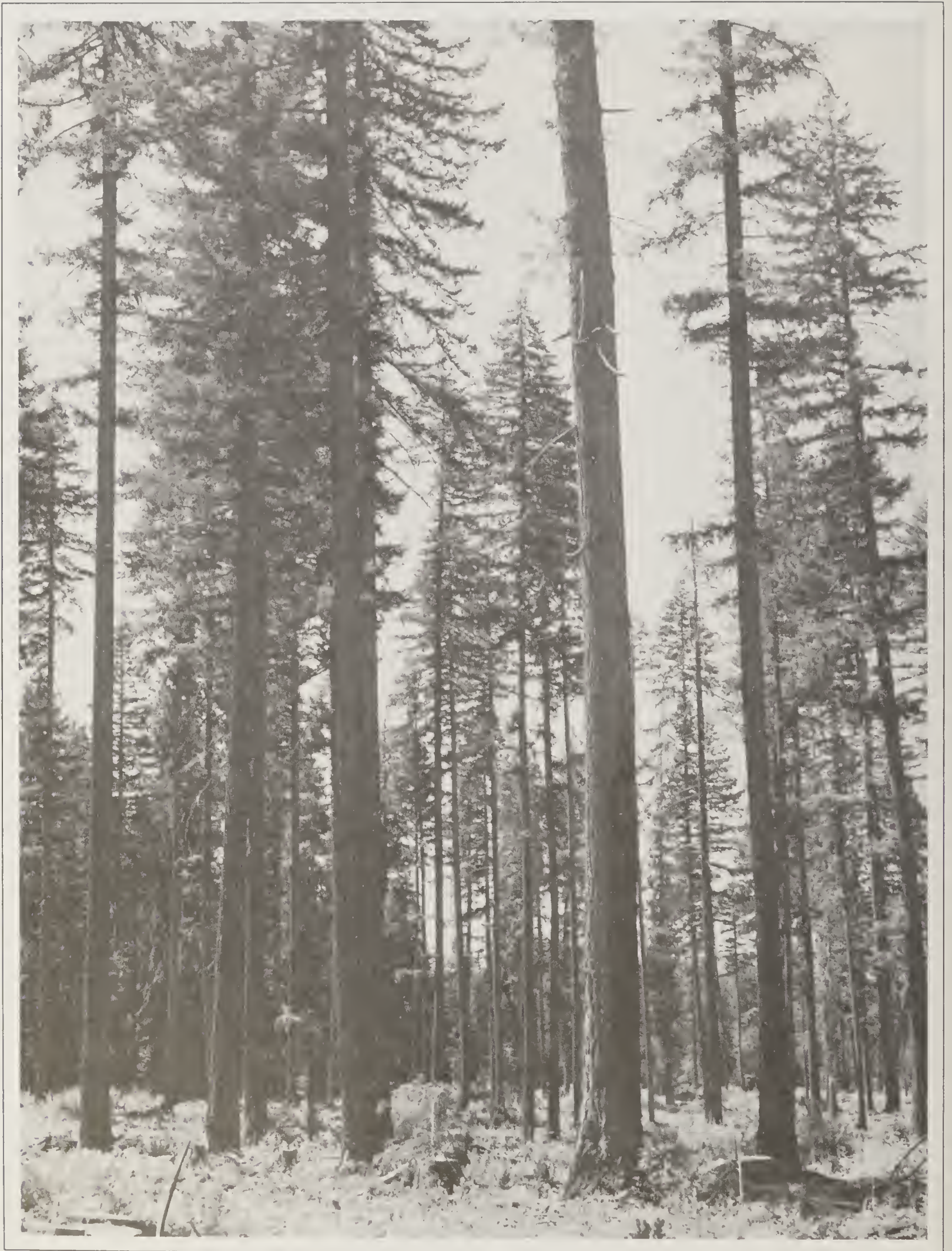


Photo by Samuel T. Frear



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Table 1—Summary of National Forest System accomplishments compared to funded output levels and 5-year average--  
fiscal year 1988

Resource area	Activity	Units 1/	1988			1984-88 average accomplishment	1988 as percent of 5-year average
			Funded	Accomplished	Percent of funded		
Resource:							
Recreation	Visitor use	MM RVD's	240.0	242.3	101	232	104
Wilderness	Management	MM acres	26.9	32.5	121	31	105
Wildlife and fish	Habitat improvement	M acres	93.7	154.1	164	224 2/	69
Range	Permitted grazing use	MM AUM's	9.9	9.9	100	10	99
Timber	Sales offering	B bd. ft.	11.5	11.3	98	11.6	97
	Silvicultural exams	MM acres	5.1	5.6	110	6	97
	Reforestation						
	Appropriated funds	M acres	119.0	158.3 3/	133	159	99
	K-V funds 4/	M acres	283.0	294.6 3/	104	231	128
	Timber stand improvement						
	Appropriated funds	M acres	187.0	199.0	106	245	81
	K-V funds	M acres	166.0	138.2	83	121	114
Soil and water	Resource improvements 5/	M acres	6.9	11.5	167	9	133
Minerals	Leases and permits	Cases	22,309.0	25,932.0	116	26,694	97
Support:	Trail construction/reconstruction	Miles	1,134.0	1,834.0	162	936	196
	Road construction						
	Appropriated funds	Miles	1,338.0 6/	1,352.2 7/	101	1,726	78
	Purchaser credit 8/	Miles	6,607.0	5,731.0	87	5,709	100
	Fuel management 9/	M acres	320.0	347.1	108	297	117
	Land acquired						
	Purchase and donation	M acres	44.5	58.4	131	56	105
	Exchanges	M acres	68.4	125.9	184	140	90
	Landline location	Miles	4,104.0	4,581.0	112	5,482	84

1/ M = thousand, MM = million, B = billion, RVD = recreation visitor day, AUM = animal unit month.

2/ Average for 1984-88 includes 197,394 acres accomplished with Knutson-Vandenberg funds in 1984.

3/ Includes natural regeneration without site preparation.

4/ K-V = Knutson Vandenberg Act.

5/ Appropriated funds only.

6/ Does not include 19.7 miles of Tongass Timber Supply Fund miles.

7/ Does not include 39.4 Tongass Timber Supply Fund miles.

8/ Average for 1984-88 includes 290 miles turned back to Forest Service in 1988, and a 1984-88 average of 346 miles.

9/ Does not include 3,044 acres accomplished through human resource programs and 338,295 acres with brush disposal funds.

The 1984-88 average is 3,788 acres accomplished through Human Resource Programs and 341,662 acres using brush disposal funds.

Table 2--National Forest System funding--fiscal year 1988 compared to 1984-88 average

	1988			1984-88 average	Percent of actual to average
	Actual	RPA low bound 1/	RPA high bound 2/		
1,000 constant 1988 dollars					
Minerals area management	26,683	26,840	26,840	28,185	94.7
Real estate management	21,834	20,430	26,350	21,514	101.5
Landline location	26,651	23,690	30,560	29,618	90.0
Maintenance of facilities	16,533	15,170	18,810	15,770	104.8
Forest fire protection	165,029	151,570	187,950	167,148	98.7
Fighting forest fires	125,000	1,030	1,280	107,437	116.3
Cooperative law enforcement	9,669	2,520	3,240	7,447	129.8
Forest road maintenance	83,740	50,720	62,890	71,557	117.0
Forest trail maintenance	20,026	8,610	13,780	12,460	160.7
Sales administration and management	185,561	176,140	237,790	197,414	94.0
Reforestation and stand improvement 3/	84,923	90,540	122,230	97,695	86.9
Recreation use	123,742	106,180	137,890	113,871	108.7
Wildlife and fish habitat management	47,444	34,780	69,560	42,021	112.9
Range management	29,225	28,640	37,800	29,459	99.2
Soil and water management	35,271	29,640	36,750	34,150	103.3
Subtotal	1,001,331	766,500	1,013,720	975,747	102.6
General Administration (subtotal)	268,660	258,250	320,230	275,683	97.5
Youth Conservation Corps	(1,000)	- 4/	-	(2,637)	37.9
Construction and land acquisition:					
Construction of facilities 5/	24,735	12,080	14,980	26,742	92.5
Forest road construction	171,764	183,750	248,060	220,443	77.9
Forest trail construction	14,671	5,120	30,000	8,653	169.6
Forest roads purchaser construction 6/	(119,508)	(158,870)	(292,230)	(172,517)	69.3
Subtotal	211,170	200,950	293,040	255,900	82.5

See footnotes at end of table.



**Table 2--National Forest System funding--fiscal year 1988 compared to 1984-88 average--**  
**Continued**

	1988			1984-88 average	Percent of actual to average
	Actual	RPA low bound 1/	RPA high bound 2/		
1,000 constant 1988 dollars					
Land acquisition	49,076	—	—	47,192	104.0
Acquisition of lands for Winema NF	0	—	—	63	0.0
Acquisition of lands for National Forests, special acts	966	—	—	891	108.4
Acquisition of lands to complete land exchange	385	—	—	725	53.1
Appropriated trust fund	3	—	—	37	8.2
Range betterment 7/	3,605	3,910	3,910	4,041	89.2
Permanent appropriations	452,270	139,390 8/	151,380 8/	473,682	95.5
Trust funds	296,334	203,450	220,950	243,823	121.5
Subtotal	802,639	346,750	376,240	160,528	500.0
Total	2,283,800	1,572,450	2,003,230	2,279,040	100.2

1/ Information from 1985-2030 Resources Planning Act-Program. FY 1988 low bound of the RPA Program is based on the President's Budget for FY 1987.

2/ The RPA high bound amounts are estimations based on the proportional relationship of each resource area in the high bound program.

3/ Includes reforestation trust fund dollars.

4/ -- = not applicable. These items were not included in the 1985-2030 RPA Program.

5/ Excludes construction of research facilities, which is included in table 51.

6/ This account was taken off budget in 1982. For comparison, the amounts are shown as non-add items.

7/ Range betterment for actual and RPA equals 50 percent of actual grazing receipts.

8/ Does not include payments to States, counties, and National Grasslands; these were not included in the RPA Program.

Table 3—National Forest System funding--fiscal years 1984-88

	1988	1987	1986	1985	1984
	<i>1,000 dollars</i>				
Minerals area management	26,683	27,007	27,164	26,572	25,670
Real estate management	21,834	20,350	19,978	20,836	18,709
Landline location	26,651	26,980	27,399	29,090	29,448
Maintenance of facilities	16,533	15,055	14,124	14,792	14,070
Forest fire protection	165,029	159,388	151,669	156,591	156,734
Fighting forest fires	125,000	125,000	166,652	62,227	35,301
Cooperative law enforcement	9,669	6,675	6,659	7,212	5,175
Forest road maintenance	83,740	63,073	61,856	65,406	64,650
Forest trail maintenance	20,026	11,385	9,537	9,256	9,267
Sales administration and management	185,561	189,640	174,007	194,702	187,547
Reforestation and stand improvement 1/	84,923	90,098	95,433	104,664	85,582
Recreation use	123,742	113,287	99,017	102,057	100,919
Wildlife and fish habitat management	47,444	42,552	37,087	36,726	35,360
Range management	29,225	27,576	26,894	28,170	27,267
Soil and water management	35,271	33,981	30,524	31,808	29,956
Subtotal	1,001,331	952,047	948,000	890,109	825,655
General Administration (subtotal)	268,660	263,121	251,229	258,844	259,865
Youth Conservation Corps 2/	(1,000)	(1,000)	(3,234)	(3,234)	(3,500)
Construction					
Construction of facilities 3/	24,735	25,663	26,211	26,228	23,445
Forest road construction	171,764	233,310	180,935	228,914	222,675
Forest trail construction	14,671	7,579	6,866	7,093	5,182
Forest roads purchaser construction 4/	(119,508)	(97,099)	(91,474)	(192,301)	(240,000)
Special projects	0	10,215 5/	0	0	0
Subtotal	211,170	276,767	214,012	262,235	251,302

See footnotes at end of table.



Table 3--National Forest System funding--fiscal years 1984-88--Continued

	1988	1987	1986	1985	1984
	1,000 dollars				
Land acquisition					
Acquisition of lands for Winema NF	49,076	52,236	31,356	50,535	40,075
Acquisition of lands for National Forests, special acts	0	0	0	0	281
Acquisition of lands to complete land exchange	966	966	744	766	780
Appropriated trust fund	385	1,573	1,086	42	380
Range betterment	3	27	12	35	90
Permanent appropriations	3,605	3,807	3,635	3,966	4,028
Trust funds	452,270	359,643	651,533	393,634	382,154
	296,334	254,019	202,517	172,541	231,103
Total	2,283,800	2,164,206	2,304,124	2,032,707	1,995,713

1/ Includes reforestation trust fund dollars.

2/ Appropriations Act required minimum level of funding from National Forest funds; amounts not included in totals.

1984 - operated a \$3.5 million program from available funds.

1985 - operated a \$3.7 million program from available funds.

1986 - operated a \$3.5 million program from available funds.

1987 - operated a \$3.6 million program from available funds.

1988 - operated a \$3.0 million program from available funds.

3/ Excludes construction of research facilities, which is included in table 51.

4/ This account was taken off budget in 1982. For comparison, the amounts are shown as non-add items.

5/ Funding for special purposes:

Mt. Elden Work Center - \$0.3 million.

Highway construction Mount St. Helens National Volcanic Monument - \$9.915 million.

Table 4-Summary of National Forest System accomplishments compared to RPA projections--fiscal year 1988

Resource area	Activity	Units 1/ Accomplished	1988	
			RPA low bound	RPA high bound
Final output 2/ Timber	Sales offering	11.3	10.0	11.5
Recreation	Visitor use	242.3	225.0	240.0
Range	Permitted grazing use	9.9	9.8	9.8
Minerals	Applications, proposals, and administration	25.9	25.0	29.0
Wildlife & fish	User-days of recreation	41.2	23.0	26.0
Intermediate output 4/				
Timber	Reforestation	461.6	335.0	390.0
	Timber stand improvement	337.2	302.0	370.0
Wildlife	Habitat improvement	154.1	-	5/
Wilderness	Management	32.5	35.0	35.0
Soil and water	Resource improvement 6/	11.5	7.8	10.0
Trails	Construction/reconstruction	1,657.0	502.0	4,129.0
Roads	Construction/reconstruction	7,082.8	6,879.0	8/
Fire	Fuels management 9/	685.3	670.0	-
Lands	Purchase and donation	58.4	-	-

1/ B = billion, MM = million, M = thousand, RVD's = recreation visitor-days, AUM's = animal unit months, WFUD's = wildlife and fish user days.

2/ Final output = forest and rangeland goods and services purchased or consumed by the private sector or individual consumers.

3/ Reported as operating plans in the 1985-2030 Resources Planning Act Program.

4/ Intermediate output = work performed by the Forest Service that contributes to the production of final outputs.

5/ -- = not applicable. These items were not reported in the RPA Program.

6/ Acres accomplished with appropriated funds only.

7/ Includes appropriated and purchaser roads. Does not include 39.4 Tongass Timber Supply Fund miles.

8/ Represents a projection of miles constructed/reconstructed for all roads and is contingent on planned resource outputs.

9/ Does not include acres accomplished through Human Resource Programs, but does include acres accomplished with brush disposal funds.



Table 5—Draft and final forest plan environmental impact statements filed by Region with the Environmental Protection Agency as of September 30, 1988 1/

Northern Region <i>Final</i>	Rocky Mountain Region <i>Final</i>	Southwestern Region <i>Final</i>	Intermountain Region <i>Draft</i>
Flathead (MT)	Rio Grande (CO)	Cibola (NM)	Bridger-Teton (WY)
Lewis & Clark (MT)	Nebraska (NE)	Tonto (AZ)	Boise (ID)
Beaverhead (MT)	Bighorn (WY)	Carson (NM)	
Helena (MT)	Arapaho-Roosevelt (CO)	Coronado (AZ)	<i>Final</i>
Lolo (MT)	Grand Mesa, Uncompahgre, and Gunnison (CO)	Gila (NM)	Uinta (UT)
Bitterroot (MT)	Routt (CO)	Lincoln (NM)	Wasatch-Cache (UT)
Custer (MT)	San Juan (CO)	Prescott (AZ)	Targhee (ID)
Deerlodge (MT)	Black Hills (SD)	Apache-Sitgreaves (AZ)	Caribou (ID)
Nezperce (ID)	White River (CO)	Coconino (AZ)	Fishlake (UT)
Gallatin (MT)	Pike-San Isabel (CO)	Santa Fe (NM)	Toiyabe (NV)
Idaho Panhandle (ID)	Medicine Bow (WY)	Kaibab (AZ)	Dixie (UT)
Clearwater (ID)	Shoshone (WY)		Humboldt (NV)
Kootenai (MT)			Payette (ID)
			Challis (ID)
			Ashley (UT)
			Sawtooth (ID)
			Manti-LaSal (UT)
			* Salmon (ID)
Pacific Southwest Region <i>Draft</i>	Pacific Northwest Region <i>Draft</i>	Southern Region <i>Final</i>	Eastern Region <i>Final</i>
Tahoe (CA)	Deschutes (OR) 2/	Francis Marion (SC)	Hoosier (IN)
Stanislaus (CA)	Okanogan (WA) 2/	Sumter (SC)	Nicolet (WI)
Lake Tahoe Basin Management Unit (CA)	Wallowa-Whitman (OR) 2/	Mississippi (MS)	Superior (MN)
San Bernardino (CA)	Wenatchee (WA) 2/	Kisatchie (LA)	Monongahela (WV)
Lassen (CA)	Siskiyou (OR)	Chattahoochee- Oconee (GA)	Chippewa (MN)
Shasta-Trinity (CA)	Ochoco (OR) 2/	Daniel Boone (KY)	Allegheny (PA)
Mendocino (CA)	Olympic (WA) 2/	Jefferson (VA)	Huron-Manistee (MI)
Sierra (CA)	Siuslaw (OR) 2/	George Washington (VA)	Chequamegon (WI)
Eldorado (CA)	Umatilla (OR)	Caribbean (PR)	Mark Twain (MO)
Modoc (CA)	Gifford Pinchot (WA)	Cherokee (TN)	Hiawatha (MI)
Six Rivers (CA)	Mt. Hood (OR)	Ozark-St. Francis (AR)	Ottawa (MI)
	Umpqua (OR)	Florida (FL)	White Mountain (NH)
	Fremont (OR)	Ouachita (AR)	Green Mountain (VT)
<i>Final</i>	Malheur (OR)	Alabama (AL)	Shawnee (IL)
Cleveland (CA)	Rogue River (OR)	Croatan-Uwharrie (NC)	Wayne (OH)
Angeles (CA)	Colville (WA)	Nantahala-Pisgah (NC)	
* Plumas (CA)	Mt. Baker (WA)	Texas (TX)	
* Sequoia (CA)	Winema (OR)		
* Los Padres (CA)	Willamette (OR)		
* Inyo (CA)			
			<b>Alaska Region</b>
			<i>Final</i>
			Chugach (AK)
			Tongass (AK) 3/

1/ Includes forest plans filed in previous years.

\* Plans filed in 1988.

2/ Draft supplements filed on R-6 forest plans in FY 1988.

3/ 1979 Tongass plan under revision with draft plan scheduled for release in December 1989.

Table 6--Planned and accomplished minerals cases by Region--fiscal year 1988

Region	Cases	
	Planned	Accomplished
Northern	4,201	3,993
Rocky Mountain	2,577	2,553
Southwestern	1,061	2,308
Intermountain	3,296	3,566
Pacific Southwest	2,469	2,965
Pacific Northwest	2,668	2,972
Southern	3,461	3,743
Eastern	1,936	2,828
Alaska	640	1,004
Total	22,309	25,932

Table 7--Energy mineral workload and production--fiscal years 1984-88 1/

Fiscal year	Acres under lease <i>Millions</i>	Energy-related cases	Energy-related cases in inventory	Oil production <i>Barrels</i>	Gas production <i>1,000 cu.ft.</i>	Coal production <i>Short tons</i>
1984	34.0	13,103	2,805	12,000,000	205,000,000	15,100,000
1985	33.3	15,473	3,533	13,000,000	217,000,000	15,600,000
1986	28.2	14,194	2,363	13,000,000	180,000,000	21,000,000
1987	23.2	14,023	1,571	19,000,000	190,000,000	41,200,000
1988 2/	17.8	13,300	1,718	22,800,000	191,000,000	41,200,000

1/ This table is scheduled to be modified in FY 1989 due to changes in the way data are collected and reported.

2/ All figures are estimated.



Table 8--Land acquisition and exchange--fiscal year 1988

	Acres	Cases	Value <i>Million dollars</i>
Purchase	58,186	794 1/	63.8
Exchange	125,854	131	96.1
Donation	257	7	0.9
Total	184,297	932	160.8

1/ Includes 613 cases in the Lake Tahoe Basin, CA and NV.

Table 9--Miles of landline location by Region--fiscal year 1988

Region	Total miles boundary	1988 mileage accomplishment	Total miles surveyed
Northern	30,664	508	6,343
Rocky Mountain	51,433	438	4,505
Southwestern	19,991	282	5,993
Intermountain	28,659	355	4,395
Pacific Southwest	29,577	917	10,757
Pacific Northwest	25,627	694	13,277
Southern	42,280	576	35,564
Eastern	42,642	695	8,148
Alaska 1/	1,536	116	1,020
Total	272,409	4,581	90,002

1/ Does not reflect changes due to Alaska Native Claims Settlement Act of 1971 (85 Stat. 688), as amended, and the Alaska Statehood Act of 1958 (72 Stat. 339), as amended. As the land selections are overlapping and/or in a constant state of change, the Region is not keeping track of the boundary changes at this time.

Table 10—Lands administered by the Forest Service as of September 30, 1988

State, Commonwealth, or Territory 1/	National Forests, pur- chase units, research areas, and other areas	National Grasslands	Land utilization projects	Total
	<i>Acres</i>			
Alabama	649,591	0	40	649,631
Alaska	22,483,751	0	0	22,483,751
Arizona	11,278,317	0	0	11,278,317
Arkansas	2,484,690	0	0	2,484,690
California	20,518,457	0	19,222	20,537,679
Colorado	13,832,729	612,023	440	14,445,192
Connecticut	24	0	0	24
Florida	1,100,086	0	0	1,100,086
Georgia	857,809	0	0	857,809
Hawaii	1	0	0	1
Idaho	20,411,013	47,746	0	20,458,759
Illinois	263,377	0	0	263,377
Indiana	187,908	0	0	187,908
Kansas	0	108,175	0	108,175
Kentucky	665,330	0	0	665,330
Louisiana	600,574	0	0	600,574
Maine	52,860	0	260	53,120
Michigan	2,802,298	0	959	2,803,257
Minnesota	2,807,855	0	0	2,807,855
Mississippi	1,148,082	0	0	1,148,082
Missouri	1,460,381	0	13,104	1,473,485
Montana	16,797,507	0	0	16,797,507
Nebraska	257,504	94,316	0	351,820
Nevada	5,104,247	0	0	5,104,247
New Hampshire	714,904	0	0	714,904
New Mexico	9,189,154	136,417	240	9,325,811
New York	13,232	0	0	13,232
North Carolina	1,221,161	0	0	1,221,161
North Dakota	743	1,105,046	0	1,105,789
Ohio	186,643	0	0	186,643
Oklahoma	249,525	46,300	0	295,825
Oregon	15,513,381	111,379	856	15,625,616
Pennsylvania	511,767	0	0	511,767
Puerto Rico	27,846	0	0	27,846
South Carolina	605,037	0	0	605,037
South Dakota	1,134,037	862,816	0	1,996,853
Tennessee	626,256	0	0	626,256
Texas	635,606	117,533	0	753,139
Utah	8,040,566	0	0	8,040,566
Vermont	326,389	0	0	326,389
Virgin Islands	147	0	0	147
Virginia	1,639,394	0	0	1,639,394
Washington	9,149,452	0	738	9,150,190
West Virginia	1,020,842	0	0	1,020,842
Wisconsin	1,509,748	0	0	1,509,748
Wyoming	8,682,523	572,211	0	9,254,734
Total	186,762,744	3,813,962	35,859	190,612,565

1/ States not listed have no lands administered by the Forest Service.



Table 11—Fuels treatment acreage accomplished by appropriation--fiscal year 1988

Region	Accomplishment			Total	RPA low bound 1/
	Forest fire protection	Volunteer and contri- buted work	Brush disposal funds		
	Acres				
Northern	12,256	10	44,900	57,166	36,494
Rocky Mountain	9,154	390	11,488	21,032	15,579
Southwestern	34,841	320	58,143	93,304	75,209
Intermountain	11,304	63	28,718	40,085	66,192
Pacific Southwest	10,460	1,536	46,290	58,286	50,790
Pacific Northwest	28,771	50	146,055	174,876	204,610
Southern	238,374	550	0	238,924	213,600
Eastern	1,570	125	2,596	4,291	7,215
Alaska	400	0	105	505	70
Total	347,130	3,044	338,295	688,469	669,759

1/ Fuel treatment acreages were not reported in the high bound of the RPA Program.

Table 12—Timber offered, sold, and harvested--fiscal years 1984-88

	1988	1987	1986	1985	1984
Offered: 1/					
Volume (billion board feet)	11.3	11.5	11.7	11.5	11.9
Sold:					
Number of sales	251,557.0	289,043	349,977	366,874	342,964
Volume (billion board feet)	11.0	11.3	11.0	10.8	10.7
Value (million dollars) 2/	1,254.4	1,003.4	757.0	558.2	698.7
Harvested:					
Volume	12.6	12.7	11.8	10.9	10.5
Value (million dollars) 3/	1,235.7	1,016.0	786.9	720.6	759.6

1/ This is the number of sales that can be converted to board feet. Not included are 224,751 sales of nonconvertible product in FY 1988.

2/ This is the high bid value from all sales sold and includes stumpage, cost of reforestation, stand improvement, and timber salvage. Does not include value of roads or brush disposal.

3/ This is the current stumpage rate for the actual volume harvested and includes the reforestation and stand improvement costs and timber salvage. Does not include value of roads or brush disposal.



Table 13—Timber offered, sold, and harvested by Region--fiscal years 1986-88

	1988			1987			1986		
	Offered 1/	Sold 2/	Harvested 3/	Offered 1/	Sold 2/	Harvested 3/	Offered 1/	Sold 2/	Harvested 3/
	<i>Million board feet</i>								
Northern 4/	967.6	913.0	977.8	1,024.1	981.3	1,104.5	1,044.0	914.9	1,024.0
Rocky Mountain	384.6	383.2	456.3	400.2	432.6	426.8	403.3	314.1	411.5
Southwestern 5/	372.6	406.6	495.2	407.2	433.2	504.3	440.6	446.9	485.5
Intermountain 5/	390.7	373.9	476.9	414.7	390.2	455.3	431.6	483.7	461.5
Pacific Southwest	1,869.5	1,953.3	2,216.3	1,496.8	1,594.8	2,011.2	1,495.0	1,508.4	1,854.1
Pacific Northwest	5,056.1	4,918.9	5,407.8	5,270.8	5,272.9	5,597.2	5,366.5	5,059.9	4,965.2
Southern 4/	1,210.4	1,185.2	1,366.1	1,302.9	1,268.5	1,424.0	1,366.6	1,295.9	1,560.7
Eastern 5/	746.9	764.2	802.6	747.2	775.6	852.3	735.8	753.1	732.6
Alaska 5/	349.3	70.0	397.3	410.6	169.8	336.4	384.4	189.7	291.4
Total	11,347.7	10,968.2	12,596.4	11,474.5	11,319.0	12,712.1	11,667.8	10,966.6	11,786.5

1/ Sales offered for the first time.

2/ Does not include the volume of long-term sales released for harvesting. Includes miscellaneous small sales that were previously offered and/or sold and were reoffered and sold in the fiscal year being displayed.

3/ Includes the volume harvested on long-term sales.

4/ Due to appeals and litigation, two National Forests in Region 1 and one National Forest in Region 8 offered little or no volume for sale in FY 1988.

5/ Includes long-term sales volume prepared in the offered column.

6/ Columns may not add due to rounding.

Table 14—Number of sales, volume, and value of timber sold on National Forest lands by size class--fiscal years 1984-88

	Sale size class					15,001MBF and over	Noncon- vertibles 2/	Total less non- convertibles 3/
	To \$300	\$301- \$2,000	\$2,001- 2,000MBF 1/	2001- 5,000MBF	5001- 15,000MBF			
1984								
Number of sales	330,252	8,693	2,834	619	555	53	206,869	343,006
Volume (MBF)	903,189	379,271	1,634,609	2,085,355	4,711,844	947,429	0	10,661,697
Value (\$1,000)	5,599.1	7,262.7	103,076.2	149,605.1	372,807.1	60,368.0	1,581.7	698,718.2
1985								
Number of sales	348,999	13,563	3,113	562	595	42	225,493	366,874
Volume (MBF)	830,237	589,475	1,698,402	1,868,425	5,063,888	768,564	0	10,818,991
Value (\$1,000)	5,810.1	8,562.2	80,568.9	100,221.6	314,475.0	48,547.3	1,662.7	558,185.1
1986								
Number of sales	325,646	20,320	2,763	587	606	55	205,132	349,977
Volume (MBF)	851,974	363,324	1,517,092	1,922,224	5,269,466	1,042,497	0	10,966,577
Value (\$1,000)	7,359.1	8,533.7	76,133.3	116,679.4	466,693.2	81,624.3	1,671.4	757,023.0
1987								
Number of sales	273,210	11,795	2,684	641	662	51	224,751	289,043
Volume (MBF)	672,064	245,148	1,533,199	2,087,251	5,833,972	947,353	0	11,318,987
Value (\$1,000)	4,615.2	4,550.9	96,869.4	163,158.6	633,067.2	101,128.6	1,885.9	1,003,389.9
1988								
Number of sales	233,567	13,791	2,806	701	652	40	249,784	251,557
Volume (MBF)	550,589	242,616	1,514,723	2,304,845	5,562,653	792,807	0	10,968,233
Value (\$1,000)	3,944.0	4,691.7	114,447.7	252,343.8	791,130.5	87,829.9	2,401.5	1,254,387.6

1/ MBF = thousand board feet.

2/ Nonconvertible products include Christmas trees, cones, burls, etc.

3/ May not add due to rounding.



Table 15—Timber sold and harvested by State--fiscal year 1988 1/

State or Commonwealth 3/	Timber sold			Timber harvested 2/	
	Sales	Volume	Value 4/	Volume	Value 4/
		MBF 5/	Actual dollars	MBF 5/	Actual dollars
Alabama	306	87,892	6,172,199	82,991	5,530,519
Alaska	54	70,022	2,035,728	397,318	1,802,039 6/
Arizona	21,651	271,432	18,012,322	332,096	26,133,909
Arkansas	3,427	229,532	18,492,513	258,409	17,361,162
California	50,591	1,973,439	220,242,603	2,195,074	223,024,698
Colorado	25,682	159,831	2,829,357	207,318	2,012,607
Florida	109	94,708	5,906,424	123,348	8,251,216
Georgia	606	66,935	3,543,789	66,308	3,272,267
Idaho	23,993	744,414	42,008,353	754,482	33,422,880
Illinois	32	11,118	215,226	12,190	459,069
Indiana	46	1,104	7,582	4,394	300,744
Kentucky	1,150	37,556	1,363,874	46,770	1,273,235
Louisiana	898	128,566	10,487,466	164,236	14,273,115
Maine	0	0	0	2,348	92,870
Michigan	652	212,746	4,987,240	215,304	4,330,491
Minnesota	309	160,777	2,295,994	153,296	1,721,963
Mississippi	911	211,833	18,228,445	244,362	21,013,998
Missouri	2,188	71,613	3,377,014	67,069	2,814,791
Montana	11,257	417,116	19,231,391	552,595	24,164,574
Nebraska	26	492	5,582	381	5,039
Nevada	1,179	1,617	18,328	2,171	30,883
New Hampshire	53	30,273	1,301,757	35,651	999,370
New Mexico	21,171	135,168	3,303,964	153,131	5,092,401
New York	24	398	56,376	66	887
North Carolina	694	56,850	1,276,377	69,785	1,717,055
North Dakota	36	29	430	29	430
Ohio	179	7,661	556,603	10,138	496,338
Oklahoma	190	20,364	1,612,008	28,672	1,591,671
Oregon	32,704	3,588,124	634,753,741	3,918,613	581,307,331
Pennsylvania	154	71,771	16,050,188	78,141	9,550,329
South Carolina	583	99,304	8,870,895	114,177	9,341,135
South Dakota	2,978	129,350	6,779,588	129,155	3,393,097
Tennessee	102	23,309	1,267,424	32,858	1,288,151
Texas	231	51,269	5,462,435	117,406	11,715,604
Utah	17,488	86,071	2,377,399	91,914	1,301,466
Vermont	86	11,788	430,360	10,761	375,942
Virginia	859	76,757	1,166,624	67,269	1,043,659
Washington	20,121	1,329,989	180,999,167	1,492,129	207,473,894
West Virginia	227	34,834	2,769,168	52,685	2,527,218
Wisconsin	155	146,728	2,239,419	162,483	2,448,762
Wyoming	8,455	115,453	3,652,257	148,838	2,777,398
Total 7/	251,557	10,968,233	1,254,387,610	12,596,361	1,235,734,207

1/ Excludes nonconvertible products such as Christmas trees, cones, burls, etc.

2/ Preliminary.

3/ States not listed had no timber sold or harvested in fiscal year 1988.

4/ Includes Knutson-Vandenberg and salvage sale receipts. Does not include brush disposal and road costs.

5/ MBF = thousand board feet.

6/ The timber sale harvest values for Alaska include repayments as a result of rate redetermination for short-term sales due to the Federal Timber Contract Payment Modification Act of 1984.

7/ Columns may not add due to rounding.

**Table 16—Values, costs, and associated outputs for the fiscal year 1988 timber sale program**

This table reserved for future use. Information for this table will be provided by the Timber Sale Program Information Reporting System (TSPIRS) when it is fully implemented. See the timber program narrative section for a more complete discussion of TSPIRS.

**Table 17—Uncut timber volume under contract by Region--fiscal years 1984-88**

Region	1988	1987	1986	1985	1984
<i>Million board feet 1/</i>					
Northern	2,382	2,618	3,274	3,812	3,986
Rocky Mountain	1,036	1,154	1,208	1,361	1,227
Southwestern	768	936	1,088	1,228	1,125
Intermountain	620	772	848	896	1,004
Pacific Southwest	3,275	3,943	4,456	7,261	6,975
Pacific Northwest	9,959	11,241	10,308	18,263	18,336
Southern	1,543	1,948	2,186	2,785	2,870
Eastern	1,778	1,820	2,054	2,034	1,909
Alaska	417	438 2/	562	509	460
Total	21,778	24,870	25,984 3/	38,149	37,892

1/ Volume in local scale. Long-term sales not included. Long-term sales volume under contract at the end of fiscal year 1988 was 6,594 million board feet and 6,364 million board feet in 1987.

2/ Corrected figure; reported wrong in 1987 report.

3/ This volume under contract has been reduced by 9,748 million board feet as a result of the Federal Timber Contract Payment Modification Act of 1984.



Table 18—Timber funding--fiscal years 1986-88

	1988	1987	1986
<i>1,000 dollars</i>			
National Forest System			
Timber management	141,228	137,463	120,931
Harvest administration	44,333	52,177	53,076
Subtotal	185,561	189,640	174,007
Support to timber sales program			
Minerals	1,077	1,521	1,126
Forest Fire Protection	3,843	4,522	3,396
Recreation	7,992	8,380	7,698
Wildlife and Fish	8,613	7,020	8,381
Range	988	797	933
Soil and Water	8,103	7,666	7,531
Subtotal	30,616	29,906	29,065
Road construction			
Forest Service construction	128,257	185,400	151,577
Purchaser construction	(103,781)	(97,099)	(91,474)
Purchaser construction by the Forest Service	4,330	5,467	6,218
Subtotal	132,587	190,867	157,795
Total, appropriated accounts	348,764	410,413	360,867
Special accounts 1/ Timber salvage sales	61,502	26,000	20,677
Tongass timber supply fund 2/	34,073	42,254	45,793
Subtotal	95,575	68,254	66,470
Total 3/	444,339	478,667	427,337

1/ Includes General Administration expenses.

2/ Does not include Reforestation/TSI.

3/ Includes Oregon and California Land Grant funding.

**Table 19—Reforestation funding and accomplishments by funding source--  
fiscal years 1984-88**

	Appropriated	Knutson-Vandenberg	Total
1984			
Million dollars 1/	49.9	77.4	127.3
1,000 acres	180.7	195.3	376.0
Constant dollars/acre	276.1	396.3	338.6 2/
1985			
Million dollars 1/	62.4	77.0	139.4
1,000 acres	175.2	194.6	369.8
Constant dollars/acre	356.2	395.7	377.0 2/
1986			
Million dollars 1/	54.5	70.9	125.4
1,000 acres	148.9	215.1	364.0
Constant dollars/acre	366.0	329.6	344.5 2/
1987			
Million dollars 1/	49.3	94.2	143.5
1,000 acres	139.4	254.8	394.2
Constant dollars/acre	353.7	369.7	364.0 2/
1988			
Million dollars 1/	47.0	114.1 4/	161.1 4/
1,000 acres	133.3 3/	282.8 5/	416.1
Constant dollars/acre	352.6	313.6	326.1

1/ All dollars are constant 1988. No General Administration funds included. Does not include funds for nursery and tree improvement.

2/ Weighted average.

3/ Does not include the 24,900 acres of certified natural regeneration without site preparation reported as established in FY 1988.

4/ Although \$114.1 million had been authorized, only \$88.7 million were obligated. The cost/acre is based upon the obligated amount. The unspent funds were returned to the K-V trust fund pool for future obligations.

5/ Does not include the 11,900 acres of certified natural regeneration without site preparation reported as established in FY 1988.



Table 20—Reforestation program needs--fiscal years 1988-90

	Current or anticipated <i>1,000 acres</i>	Annual program appropriated funds 1/ <i>1,000 acres</i>	<i>Million dollars</i>
10/1/87 balance	1,099		
Fiscal year 1988:			
New needs 2/	530		
Projected accomplishments 3/	-453	158.3	47.021
10/1/88 balance	1,176		
Fiscal year 1989:			
New needs 2/	500		
Projected accomplishments 3/	-460	129.0	47.527
10/1/89 balance	1,216		
Fiscal year 1990:			
New needs 2/	465		
Projected accomplishments 3/	-513	133.0	50.730
10/1/90 balance	1,168		

1/ Includes Reforestation Trust Fund pursuant to P.L. 96-451, as amended.

2/ New needs are the results of timber harvests, regeneration failures, and natural disasters such as fires, storms, insects, diseases, and other changes. Fiscal years 1987 and 1988 had record levels of new needs created by timber harvests, wildfires, and insect epidemics.

3/ Beginning in fiscal year 1988, natural regeneration without site preparation is included in the accomplishment projections.

Table 21—Reforestation needs as of October 1, 1988, by State, forest, and site productivity class

State, Commonwealth, or Territory 1/ National Forest	Acres by site productivity class 2/				Total acres
	0-49	50-84	85-119	120+	
Alabama					
NFs in Alabama (subtotal)	0	5,952	4,073	812	10,837
Alaska					
Chugach	0	125	0	0	125
Tongass-Chatham	0	1,835	193	2,666	4,694
Tongass-Ketchikan	0	0	127	13,737	13,864
Tongass-Stikine	0	68	493	4,556	5,117
Subtotal	0	2,028	813	20,959	23,800
Arizona					
Apache-Sitgreaves	0	38	40	0	78
Coconino	0	297	80	0	377
Kaibab	0	3,294	0	0	3,294
Prescott	0	57	0	0	57
Tonto	16	435	0	0	451
Subtotal	16	4,121	120	0	4,257
Arkansas					
Ouachita	445	16,900	16,309	951	34,605
Ozark-St. Francis	0	4,037	217		4,254
Subtotal	445	20,937	16,526	951	38,859
California					
Angeles	0	444	27	0	471
Cleveland	321	4	0	0	325
Eldorado	0	9	5,754	2,180	7,943
Inyo	247	870	0	0	1,117
Klamath	4,843	11,756	13,259	11,125	40,983
Lassen	0	6,527	2,355	1,153	10,035
Los Padres	50	506	131	69	756
Mendocino	4,779	20,512	8,109	2,795	36,195
Modoc	0	5,064	1,486	263	6,813
Plumas	0	4,716	9,323	1,244	15,283
Rogue River	0	86	368	0	454
San Bernardino	46	391	44	0	481
Sequoia	289	6,662	3,987	933	11,871
Shasta	0	3,816	6,584	4,358	14,758

See footnotes at end of table.



Table 21—Reforestation needs as of October 1, 1988, by State, forest, and site productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	Acres by site productivity class 2/				Total acres
	0-49	50-84	85-119	120+	
Sierra	0	3,344	3,811	2,675	9,830
Siskiyou	0	0	1,128	0	1,128
Six Rivers	0	82	5,553	2,275	7,910
Stanislaus	321	4,765	32,751	6,286	44,123
Tahoe	1,121	4,034	6,650	10,337	22,142
Trinity	116	236	10,226	200	10,778
Toiyabe	1,219	67	0	0	1,286
Lake Tahoe Basin	0	0	22	0	22
Subtotal	13,352	73,891	111,568	45,893	244,704
Colorado					
Arapaho and Roosevelt	8,397	2,755	0	0	11,152
Grand Mesa, Uncompahgre, and Gunnison	680	1,093	84	0	1,857
Pike and San Isabel	1,837	419	0	0	2,256
Routt	3,710	1,500	0	0	5,210
San Juan	4,611	4,552	109	0	9,272
White River	23	483	35	0	541
Subtotal	19,258	10,802	228	0	30,288
Florida					
NFs in Florida (subtotal)	13,788	9,649	2,849	472	26,758
Georgia					
Chattahoochee and Oconee (subtotal)	0	2,486	5,241	296	8,023
Idaho					
Boise	910	2,130	6,461	2,148	11,649
Caribou	0	262	85	0	347
Challis	74	769	3		846
Clearwater	6,794	179	2,548	9,116	18,637
Idaho Panhandle	10,832	1,687	7,928	6,205	26,652
Kootenai	17	0	590	153	760
Lolo	0	21	0	0	21
Nezperce	5,904	1,186	2,986	1,263	11,339
Payette	349	2,805	2,796	0	5,950
Salmon	5,207	3,259	0	0	8,466
Sawtooth	323	0	0	0	323
Targhee	0	10,106	0	0	10,106
Subtotal	30,410	22,404	23,397	18,885	95,096

See footnotes at end of table.

Table 21—Reforestation needs as of October 1, 1988, by State, forest, and site productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	Acres by site productivity class 2/				Total acres
	0-49	50-84	85-119	120+	
Illinois					
Shawnee (subtotal)	48	946	0	0	994
Indiana					
Hoosier (subtotal)	1	27	1,452	590	2,070
Kentucky					
Daniel Boone (subtotal)	67	1,946	7,932	248	10,193
Louisiana					
Kisatchie (subtotal)	0	941	2,686	14,468	18,095
Maine					
White Mountain (subtotal)	141	162	53	12	368
Michigan					
Hiawatha	1,853	2,047	349	69	4,318
Huron-Manistee	3,672	3,300	160	35	7,167
Ottawa	1,034	9,689	1,545	0	12,268
Subtotal	6,559	15,036	2,054	104	23,753
Minnesota					
Chippewa	280	824	322	0	1,426
Superior	1,964	4,731	717	260	7,672
Subtotal	2,244	5,555	1,039	260	9,098
Mississippi					
NFs in Mississippi (subtotal)	219	2,873	9,235	13,078	25,405
Missouri					
Mark Twain (subtotal)	7,201	11,298	79		18,578
Montana					
Beaverhead	5,617	3,990	169	0	9,776
Bitterroot	4,695	1,461	792	154	7,102
Custer	538	152	90	3	783
Deerlodge	3,619	327	151	0	4,097
Flathead	11,676	1,733	4,603	769	18,781
Gallatin	1,775	2,738	46	16	4,575
Helena	4,739	1,283	692	27	6,741
Kootenai	16,548	7,285	16,587	2,341	42,761
Lewis and Clark	1,046	735	350	0	2,131
Lolo	3785	4554	2680	400	11419
Subtotal	54,038	24,258	26,160	3,710	108,166

See footnotes at end of table.



Table 21—Reforestation needs as of October 1, 1988, by State, forest, and site productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	Acres by site productivity class 2/				Total acres
	0-49	50-84	85-119	120+	
Nevada					
Lake Tahoe Basin (subtotal)	0	0	30	0	30
New Hampshire					
White Mountain (subtotal)	775	851	305	69	2,000
New Mexico					
Carson	752	3,290	0	0	4,042
Cibola	0	1,121	0	0	1,121
Gila	669	1,187	0	0	1,856
Lincoln	0	1,033	0	0	1,033
Santa Fe	0	5,119	1,297	0	6,416
Subtotal	1,421	11,750	1,297	0	14,468
New York					
Green Mountain (subtotal)	0	1	0	0	1
North Carolina					
NFs in North Carolina (sub)	286	3,650	91	507	4,534
Ohio					
Wayne (subtotal)	81	395	1,213	1,416	3,105
Oklahoma					
Ouachita (subtotal)	0	1,126	784	440	2,350
Oregon					
Deschutes	1,866	8,912	275	333	11,386
Fremont	4,647	4,599	1,942	8	11,196
Klamath	0	0	339	834	1,173
Malheur	1,672	8,831	0	0	10,503
Mt. Hood	58	15,729	12,117	2,272	30,176
Ochoco	957	2,234	36	0	3,227
Rogue River	0	2,967	8,688	182	11,837
Siskiyou	0	543	6,094	3,111	9,748
Siuslaw	0	0	0	9,211	9,211
Umatilla	896	11,408	237	0	12,541
Umpqua	30	1,032	11,814	2,222	15,098
Wallowa-Whitman	5,569	22,624	5,256	40	33,489
Willamette	0	1,433	12,759	16,064	30,256
Winema	6,228	2,455	1,772	2,280	12,735
Subtotal	21,923	82,767	61,329	36,557	202,576

See footnotes at end of table.

Table 21--Reforestation needs as of October 1, 1988, by State, forest, and site productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	Acres by site productivity class 2/				Total acres
	0-49	50-84	85-119	120+	
Pennsylvania					
Allegheny (subtotal)	3,964	4,931	0	0	8,895
Puerto Rico					
Caribbean (subtotal)	0	0	24	0	24
South Carolina					
Francis Marion and Sumpter (subtotal)	0	235	2,418	4,336	6,989
South Dakota					
Black Hills (subtotal)	8,875	12,243	21	0	21,139
Tennessee					
Cherokee (subtotal)	22	718	648	1,849	3,237
Texas					
NFs in Texas (subtotal)	0	5,655	14,289	3,805	23,749
Utah					
Ashley	49,186	17,312	0	0	66,498
Dixie	795	1,855	0	0	2,650
Fishlake	0	210	0	0	210
Manti-LaSal	0	364	100	0	464
Uinta	0	0	408	0	408
Watsatch-Cache	449	323	0	0	772
Subtotal	50,430	20,064	508	0	71,002
Vermont					
Green Mountain (subtotal)	106	575	354	0	1,035
Virginia					
George Washington	1,105	667	75	835	2,682
Jefferson	118	2,334	311	595	3,358
Subtotal	1,223	3,001	386	1,430	6,040

See footnotes at end of table.



Table 21—Reforestation needs as of October 1, 1988, by State, forest, and site productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	Acres by site productivity class 2/				Total acres
	0-49	50-84	85-119	120+	
Washington					
Colville	1,208	2,601	4,660	0	8,469
Gifford Pinchot	23	7,837	6,194	3,188	17,242
Idaho Panhandle	454	10	598	370	1,432
Mt. Baker-Snoqualmie	0	526	5,137	1,214	6,877
Okanogan	4,853	3,700	0	0	8,553
Olympic	0	885	6,260	5,052	12,197
Umatilla	0	302	0	0	302
Wenatchee	579	4,925	4,868	4,233	14,605
Subtotal	7,117	20,786	27,717	14,057	69,677
West Virginia					
George Washington	69	174	25	145	413
Monongahela	0	0	278	238	516
Subtotal	69	174	303	383	929
Wisconsin					
Chequamegon	0	4,742	507	0	5,249
Nicolet	598	4,064	452	384	5,498
Subtotal	598	8,806	959	384	10,747
Wyoming					
Black Hills	2,404	6,105	0	0	8,509
Bighorn	2,134	1,354	0	0	3,488
Bridger-Teton	0	1,704	2,455	0	4,159
Medicine Bow	5,322	12	0	0	5,334
Shoshone	1,966	659	174	0	2,799
Subtotal	11,826	9,834	2,629	0	24,289
Total	256,503	402,874	330,810	185,971	1,176,158

1/ States not listed had no reforestation needs as of October 1, 1988.

2/ Site productivity class refers to the amount of wood produced in cubic feet per acre per year in a natural unmanaged stand.

**Table 22—Timber stand improvement funding and accomplishments by funding source--  
fiscal years 1984-88**

	Appropriated	Knutson-Vandenberg	Total
1984			
Million dollars 1/	29.3 2/	24.6	53.9
1,000 acres	250.1 2/	111.5	361.6
Constant dollars/acre	117.2	220.6	149.1 2/
1985			
Million dollars 1/	36.5	21.0	57.5
1,000 acres	300.5	120.9	421.4
Constant dollars/acre	121.5	173.7	136.4 2/
1986			
Million dollars 1/	30.7	19.9	50.6
1,000 acres	259.4	100.7	360.1
Constant dollars/acre	118.4	197.6	140.5 2/
1987			
Million dollars 1/	28.1	28.9 4/	57 4/
1,000 acres	222.7 3/	134.2	356.9 3/
Constant dollars/acre	126.2 3/	149	134.8 2/ 3/
1988			
Million dollars 1/	23.2	31.1 5/	54.3 5/
1,000 acres	199.0	138.2	337.2
Constant dollars/acre	116.6	151.2	130.8 2/

1/ All dollars are constant 1988. No General Administration funds included. Does not include funds for nursery and tree improvement.

2/ Weighted average.

3/ Accomplishments and costs include the \$3.4 million and 8,431 acres done with Tongass timber funds.

4/ Although \$28.1 million had been authorized, only \$19.4 million were obligated and the cost/acre is based upon the obligated amount. The unspent funds were returned to the K-V trust fund pool for future obligation.

5/ Although \$31.1 million had been authorized, only \$20.9 million were obligated. The cost/acre is based upon the obligated amount. The unspent funds were returned to the K-V trust fund pool for future obligation.



Table 23—Timber stand improvement program needs--fiscal years 1988-90

	Work needs	Annual program, appropriated funds 1/	
	1,000 acres	1,000 acres	Million dollars
10/1/87 balance	1,231		
Fiscal year 1988:			
New needs	388		
Accomplishments	-337	199.0	23.2
10/1/88 balance	1,282		
Fiscal year 1989:			
New needs	350		
Projected accomplishments	-366	178.5	31.9
10/1/89 balance	1,266 2/		
Fiscal year 1990:			
New needs	350		
Projected accomplishments	-274	87.0	18.2
10/1/90 balance	1,342 2/		

1/ Includes Reforestation Trust Fund pursuant to P.L. 96-451, as amended.

2/ This represents over 4 years of future accomplishments.

Table 24—Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement				Total	Release subtotal	Thinning subtotal	Fertili- zation subtotal	Pruning subtotal
	Cubic foot productivity classes 2/ Acres								
	0-49	50-84	85-119	120+					
Alabama									
NFs in Alabama (subtotal)	0	1,909	4,004	425	6,338	6,338	0	0	0
Alaska									
Chugach	0	26	523	0	549	0	549	0	0
Tongass-Chatham	0	0	815	2,360	3,175	1,812	1,363	0	0
Tongass-Ketchikan	0	0	0	38,888	38,888	1,138	37,750	0	0
Tongass-Stikine	30	10	199	6,103	6,342	0	6,342	0	0
Subtotal	30	36	1,537	47,351	48,954	2,950	46,004	0	0
Arizona									
Apache-Sitgreaves	16	3,207	581	0	3,804	0	3,804	0	0
Coconino	2,424	10,605	0	0	13,029	0	13,029	0	0
Kaibab	0	13,279	0	0	13,279	192	13,087	0	0
Prescott	162	0	0	0	162	0	162	0	0
Tonto	1,445	2,978	0	0	4,423	800	3,623	0	0
Subtotal	4,047	30,069	581	0	34,697	992	33,705	0	0
Arkansas									
Ouachita	1,043	14,862	3,218	100	19,223	13,748	5,475	0	0
Ozark-St. Francis	0	6,259	244	0	6,503	3,307	3,196	0	0
Subtotal	1,043	21,121	3,462	100	25,726	17,055	8,671	0	0
California									
Angeles	0	1,002	0	0	1,002	288	649	25	40
Cleveland	334	1,389	0	0	1,723	110	1,613	0	0
Eldorado	0	23	7,065	1,838	8,926	7,413	1,280	233	0
Inyo	0	1,558	2	0	1,560	46	1,514	0	0
Klamath	4,412	22,154	24,860	10,376	61,802	38,071	23,731	0	0
Lake Tahoe Basin	0	0	22	0	22	5	17	0	0
Lassen	0	8,173	4,579	2,432	15,184	3,164	12,020	0	0
Los Padres	185	976	175	200	1,536	609	927	0	0
Mendocino	213	6,209	4,667	1,767	12,856	9,540	2,557	759	0

See footnotes at end of table.



Table 24—Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement				Total	Release subtotal	Thinning subtotal	Fertili- zation subtotal	Pruning subtotal
	Cubic foot productivity classes 2/ Acres								
	0-49	50-84	85-119	120+					
Modoc	920	11,623	9,104	1,511	23,158	14,048	8,317	793	0
Plumas	113	12,684	12,696	3,850	29,343	11,558	16,730	1,055	0
San Bernardino	967	2,933	413	0	4,313	1,218	3,095	0	0
Sequoia	138	3,361	4,759	1,079	9,337	6,119	2,546	672	0
Shasta	0	6,062	14,946	14,113	35,121	31,504	3,617	0	0
Sierra	5	4,419	2,941	1,053	8,418	5,447	2,971	0	0
Siskiyou	0	0	1,213	0	1,213	995	56	162	0
Six Rivers	0	791	22,586	18,394	41,771	37,401	4,243	127	0
Stanislaus	151	2,323	4,570	2,470	9,514	7,509	2,005	0	0
Tahoe	6,518	6,038	6,034	18,597	37,187	26,489	10,698	0	0
Trinity	0	4,786	1,679	3,007	9,472	8,552	789	131	0
Toiyabe	2,956	1,893	0	0	4,849	2,462	2,387	0	0
Subtotal	16,912	98,397	122,311	80,687	318,307	212,548	101,762	3,957	40
Colorado									
Arapahoe-Roosevelt	6,046	4,449	0	0	10,495	1,917	8,578	0	0
Grand Mesa, Uncompahgre, and Gunnison	3,647	705	0	0	4,352	1,275	3,077	0	0
Manti-LaSal	0	0	95	0	95	0	95	0	0
Pike and San Isabel	2,619	385	112	0	3,116	1,786	1,330	0	0
Rio Grande	2,403	19,722	3,368	0	25,493	15,250	10,243	0	0
Routt	2,108	2,363	0	0	4,471	1,304	3,167	0	0
San Juan	1,702	722	0	0	2,424	2,289	135	0	0
White River	511	716	716	0	1,943	1,481	462	0	0
Subtotal	19,036	29,062	4,291	0	52,389	25,302	27,087	0	0
Florida									
NFs in Florida (subtotal)	31	3,684	2,227	106	6,048	1,345	300	4,403	0
Georgia									
Chattahoochee and Oconee (subtotal)	0	1,805	6,273	2,069	10,147	5,202	4,945	0	0

See footnotes at end of table.

Table 24—Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement Cubic foot productivity classes 2/ Acres					Total	Release subtotal	Thinning subtotal	Ferti- lization subtotal	Pruning subtotal
	0-49	50-84	85-119	120+						
Idaho										
Boise	625	1,733	3,252	1,110		6,720	3,332	3,388	0	0
Caribou	0	909	263	0		1,172	689	483	0	0
Challis	285	1,330	0	0		1,615	405	1,210	0	0
Clearwater	1,612	22	869	3,968		6,471	1,097	5,374	0	0
Idaho Panhandle	4,807	2,005	9,601	9,918		26,331	6,028	20,303	0	0
Kootenai	116	0	312	243		671	116	555	0	0
Nezperce	1,342	1,231	1,589	190		4,352	1,478	2,874	0	0
Payette	358	3,115	3,478	260		7,211	1,285	5,926	0	0
Salmon	2,359	1,732	0	0		4,091	2,594	1,497	0	0
Targhee		2,463	0	0		2,463	714	1,749	0	0
Sawtooth	396	40	0	0		436	168	268	0	0
Subtotal	11,900	14,580	19,364	15,689		61,533	17,906	43,627	0	0
Illinois										
Shawnee (subtotal)	0	179	86	0		265	179	0	0	86
Indiana										
Hoosier (subtotal)	0	188	1,029	6,098		7,315	3,902	1,385	0	2,028
Kentucky										
Daniel Boone (subtotal)	12	1,387	5,654	596		7,649	1,462	6,144	3	40
Louisiana										
Kisatchie (subtotal)	0	186	1,627	2,217		4,030	2,616	1,414	0	0
Maine										
White Mountain (subtotal)	140	64	56	9		269	210	59	0	0
Michigan										
Hiawatha	412	5,722	2,328	0		8,462	1,724	1,142	0	5,596
Huron-Manistee	2,044	4,504	685	0		7,233	4,736	2,497	0	0
Ottawa	0	125	683	0		808	808	0	0	0
Subtotal	2,456	10,351	3,696	0		16,503	7,268	3,639	0	5,596

See footnotes at end of table.



Table 24--Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement				Total	Release subtotal	Thinning subtotal	Ferti- zation subtotal	Pruning subtotal
	Cubic foot productivity classes 2/ Acres								
	0-49	50-84	85-119	120+					
Minnesota									
Chippewa	0	1,133	1,369	0	2,502	2,072	0	0	430
Superior	3,467	383	161	82	4,093	4,093	0	0	0
Subtotal	3,467	1,516	1,530	82	6,595	6,165	0	0	430
Mississippi									
NFs in Mississippi (subtotal)	681	2,646	741	6,254	10,322	6,839	2,117	1,366	0
Missouri									
Mark Twain (subtotal)	0	15,250	125	0	15,375	5,445	9,813	0	117
Montana									
Beaverhead	2,152	2,314	330	38	4,834	1,586	3,248	0	0
Bitterroot	4,025	414	1,140	76	5,655	2,073	3,582	0	0
Custer	1,963	42	173	0	2,178	994	1,184	0	0
Deerlodge	6,518	2,441	837	0	9,796	2,301	7,495	0	0
Flathead	1,373	3,201	10,048	1,454	16,076	1,204	14,854	0	18
Gallatin	462	1,732	330	13	2,537	72	2,465	0	0
Helena	432	479	616	12	1,539	441	1,098	0	0
Idaho Panhandle	10	0	133	0	143	10	133	0	0
Kootenai	2,885	3,275	12,584	6,429	25,173	1,214	23,959	0	0
Lewis and Clark	1,464	1,094	664	0	3,222	965	2,257	0	0
Lolo	1,043	3,139	1,999	642	6,823	223	6,593	0	7
Subtotal	22,327	18,131	28,854	8,664	77,976	11,083	66,868	0	25
Nebraska									
Nebraska (subtotal)	50	85	0	0	135	0	135	0	0
New Hampshire									
White Mountain (subtotal)	399	318	274	11	1,002	831	171	0	0

See footnotes at end of table.

Table 24—Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement Cubic foot productivity classes 2/ Acres				Total	Release subtotal	Thinning subtotal	Fertiliz- ation subtotal	Pruning subtotal
	0-49	50-84	85-119	120+					
New Mexico									
Carson	3,024	5,497	300	0	8,821	364	8,457	0	0
Cibola	0	5,164	0	0	5,164	0	5,164	0	0
Gila	0	6,511	470	0	6,981	400	6,581	0	0
Lincoln	0	867	0	0	867	0	867	0	0
Santa Fe	0	3,887	3,256	0	7,143	0	7,143	0	0
Subtotal	3,024	21,926	4,026	0	28,976	764	28,212	0	0
New York									
Finger Lakes (subtotal)	0	745	203	0	948	73	875	0	0
North Carolina									
NFs in North Carolina (sub)	70	2,105	1,255	2,556	5,986	5,045	679	262	0
Ohio									
Wayne (subtotal)	0	45	808	4,200	5,053	2,445	1,261	0	1,347
Oklahoma									
Ouachita (subtotal)	0	1,092	175	67	1,334	749	585	0	0
Oregon									
Deschutes	18,814	42,998	2,883	139	64,834	1,431	63,403	0	0
Fremont	6,985	7,772	36	0	14,793	1,970	12,823	0	0
Klamath	0	0	250	856	1,106	558	548	0	0
Malheur	3,940	12,980	0	0	16,920	537	16,383	0	0
Mt. Hood	100	6,289	10,435	1,863	18,687	784	8,872	9,010	21
Ochoco	11,109	871	0	0	11,980	359	11,621	0	0
Rogue River	0	550	12,357	1,293	14,200	11,802	1,191	1,207	0
Siskiyou	69	2,587	24,194	5,586	32,436	18,034	8,879	5,523	0
Siuslaw	0	0	0	8,378	8,378	3,810	3,374	994	200
Umatilla	547	2,403	0	0	2,950	148	2,802	0	0
Umpqua	0	705	41,483	5,528	47,716	5,914	12,346	29,456	0
Wallowa-Whitman	2,518	10,278	1,228	0	14,024	3,312	10,712	0	0

See footnotes at end of table.



Table 24—Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement				Total	Release subtotal	Thinning subtotal	Fertil- ization subtotal	Pruning subtotal
	Cubic foot productivity classes 2/ Acres								
	0-49	50-84	85-119	120+					
Willamette Winema	0 9,330	945 7,534	13,633 593	22,167 248	36,745 17,705	5,418 1,792	16,709 15,906	14,518 7	100 0
Subtotal	53,412	95,912	107,092	46,058	302,474	55,869	185,569	60,715	321
Puerto Rico Caribbean (subtotal)	0	300	1,100	0	1,400	800	600	0	0
South Carolina Francis Marion & Sumpter (sub	0	260	2,442	1,281	3,983	1,495	2,189	299	0
South Dakota Black Hills Custer	4,570 30	4,409 0	15 0	0 0	8,994 30	0 0	8,994 30	0 0	0 0
Subtotal	4,600	4,409	15	0	9,024	0	9,024	0	0
Tennessee Cherokee (subtotal)	0	1,354	671	1,259	3,284	2,424	860	0	0
Texas NFs in Texas (subtotal)	0	1,058	2,441	1,159	4,658	3,642	1,016	0	0
Utah Ashley Dixie Fishlake Manti-LaSal Uinta Wasatch-Cache	2,762 3,240 0 0 0 415	423 14,641 270 801 0 835	0 0 0 1,361 151 0	0 0 0 200 0 0	3,185 17,881 270 2,362 151 1,250	0 855 230 0 151 300	3,185 17,026 40 2,362 0 950	0 0 0 0 0 0	0 0 0 0 0 0
Subtotal	6,417	16,970	1,512	200	25,099	1,536	23,563	0	0

See footnotes at end of table.

Table 24—Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement				Total	Release subtotal	Thinning subtotal	Fertili- zation subtotal	Pruning subtotal
	Cubic foot productivity classes 2/ Acres								
	0-49	50-84	85-119	120+					
Vermont									
Green Mountain (subtotal)	1,107	1,919	363	0	3,389	1,904	1,485	0	0
Virginia									
George Washington	75	321	89	402	887	847	40	0	0
Jefferson	37	899	257	912	2,105	1,063	1,042	0	0
Subtotal	112	1,220	346	1,314	2,992	1,910	1,082	0	0
Washington									
Colville	4	827	2,061	0	2,892	1,892	1,000	0	0
Gifford Pinchot	28	19,461	8,558	6,794	34,841	969	27,215	6,657	0
Idaho Panhandle	22	100	821	401	1,344	352	992	0	0
Mt. Baker-Snoqualmie	0	1,881	8,117	3,145	13,143	842	10,272	2,029	0
Okanogan	3,111	597	0	0	3,708	942	2,766	0	0
Olympic	85	913	8,841	1,759	11,598	485	6,220	4,893	0
Umatilla	1,631	0	0	0	1,631	0	1,631	0	0
Wenatchee	0	17,390	4,481	45,803	67,674	5,762	36,551	24,585	776
Subtotal	4,881	41,169	32,879	57,902	136,831	11,244	86,647	38,164	776
West Virginia									
George Washington	60	141	0	0	201	201	0	0	0
Monongahela	0	94	926	85	1,105	831	274	0	0
Subtotal	60	235	926	85	1,306	1,032	274	0	0

See footnotes at end of table.



Table 24--Timber stand improvement needs as of October 1, 1988, by State, forest, and cubic foot productivity class--Continued

State, Commonwealth, or Territory 1/ National Forest	All timber stand improvement				Total	Release subtotal	Thinning subtotal	Fertil- ization subtotal	Pruning subtotal
	Cubic foot productivity classes 2/ Acres								
	0-49	50-84	85-119	120+					
Wisconsin									
Chequamegon	0	736	0	0	736	716	20	0	0
Nicolet	103	1,395	1,108	236	2,842	1,126	200	0	1,516
Subtotal	103	2,131	1,108	236	3,578	1,842	220	0	1,516
Wyoming									
Black Hills	94	266	0	0	360	0	360	0	0
Bighorn	12,228	279	0	0	12,507	1,603	10,904	0	0
Bridger-Teton	130	322	927	0	1,379	0	1,379	0	0
Medicine Bow	6,959	233	0	0	7,192	116	7,076	0	0
Shoshone	7,548	1,565	9	0	9,122	954	8,168	0	0
Subtotal	26,959	2,665	936	0	30,560	2,673	27,887	0	0
Total	183,276	446,479	366,020	286,675	1,282,450	431,085	729,874	109,169	12,322

1/ States not listed had no timber stand improvement needs as of October 1, 1988.

2/ Cubic foot productivity class refers to the cubic feet of wood produced per acre per year in a natural unmanaged stand.

Table 25—Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--fiscal year 1988

State, Commonwealth, or Territory 1/ National Forest	Reforestation				Timber stand improvement			
	Artificial regeneration		Natural regeneration		Fertil-		Pruning	
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/	Release	Thinning	zation	Total
Acres								
Alabama								
NFs in Alabama (subtotal)	2,609	0	864	0	646	0	0	646
Alaska								
Tongass-Chatam	130	0	0	683	0	824	0	824
Tongass-Ketchikan	364	0	0	2,896	1,455	14,809	0	16,264
Tongass-Stikine	260	0	0	1,000	0	4,981	0	4,981
Subtotal	754	0	0	4,579	1,455	20,614	0	22,069
Arizona								
Apache-Sitgreaves	0	0	0	0	0	1,186	0	1,186
Kaibab	0	0	0	0	0	2,677	0	2,677
Subtotal	0	0	0	0	0	3,863	0	3,863
Arkansas								
Ouachita	18,373	334	572	200	10,481	1,025	0	11,506
Ozark-St. Francis	2,346	0	2,120	0	5,109	1,719	0	6,828
Subtotal	20,719	334	2,692	200	15,590	2,744	0	18,334
California								
Angeles	18	0	110	0	299	45	0	426
Eldorado	0	0	0	0	746	31	0	777
Klamath	421	0	0	0	201	158	1	360
Lassen	257	0	0	0	840	693	0	1,533
Mendocino	134	0	0	0	146	208	0	354
Plumas	277	0	0	47	905	0	0	905
San Bernardino	0	0	0	0	125	125	0	250
Sequoia	0	0	66	0	667	0	0	667

See footnotes at end of table.



Table 25--Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--fiscal year 1988--Continued

State, Commonwealth, or Territory 1/ National Forest	Reforestation										Timber stand improvement			
	Artificial regeneration		Natural regeneration		Total	Acres				Thinning	Fertil- ization	Pruning	Total	
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/		Release								
Shasta	0	0	0	0	0	3,283	945	0	0	0	4,228			
Stanislaus	30	0	0	0	30	178	0	0	0	0	178			
Tahoe	0	0	0	0	0	551	0	0	0	0	551			
Trinity	0	0	0	0	0	1,974	18	0	0	0	1,992			
Subtotal	1,137	0	176	47	1,360	9,915	2,223	1	82	12,221				
Colorado														
Arapaho and Roosevelt	0	0	0	784	784	0	0	0	0	0	0			
Pike and San Isabel	153	10	310	81	554	123	116	0	0	0	239			
Rio Grande	194	0	65	71	330	0	202	0	0	0	202			
Routt	363	106	0	5,207	5,676	15	85	0	0	0	100			
San Juan	517	0	114	874	1,505	925	153	0	0	0	1,078			
White River	69	0	50	328	447	0	496	0	0	0	496			
Subtotal	1,296	116	539	7,345	9,296	1,063	1,052	0	0	0	2,115			
Florida														
NFs in Florida (subtotal)	2,283	2,876	0	154	5,313	272	0	1,228	0	0	1,500			
Georgia														
Chattahoochee-														
Oconee (subtotal)	4,089	0	1,048	0	5,137	6,460	0	0	0	0	6,460			
Idaho														
Boise	411	0	0	0	411	3,001	18,244	0	0	0	21,245			
Challis	96	0	0	0	96	50	0	0	0	0	50			
Clearwater	1,054	43	41	160	1,298	167	531	0	0	0	698			
Idaho Panhandle	3,881	80	620	1,501	6,082	1,372	3,238	0	82	0	4,692			
Kootenai	248	0	0	7	255	0	0	0	0	0	0			

See footnotes at end of table.

Table 25--Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--fiscal year 1988--Continued

State, Commonwealth, or Territory 1/ National Forest	Reforestation				Acres					Timber stand improvement			
	Artificial regeneration		Natural regeneration		Total	Release	Thinning	Fertil- ization	Pruning	Total			
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/									
Nezperce	4,982	0	117	2,866	7,965	223	724	0	0	0	947		
Payette	816	0	0	0	816	0	1,194	0	0	0	1,194		
Salmon	74	0	1,005	631	1,710	0	0	0	0	0	0		
Sawtooth	501	0	0	0	501	0	0	0	0	0	0		
Targhee	2,680	0	22,647	0	25,327	0	0	0	0	0	0		
Subtotal	14,743	123	24,430	5,165	44,461	4,813	23,931	0	82	28,826			
Illinois													
Shawnee (subtotal)	793	0	0	0	793	139	0	0	0	0	139		
Indiana													
Hoosier (subtotal)	445	0	949	0	1,394	135	0	0	0	0	135		
Kentucky													
Daniel Boone (subtotal)	2,074	0	804	0	2,878	2,054	128	0	0	0	2,182		
Louisiana													
Kisatchie (subtotal)	3,816	516	0	0	4,332	345	0	0	0	0	345		
Maine													
White Mountain (subtotal)	157	0	0	0	157	55	0	0	0	0	55		
Michigan													
Hiawatha	795	164	1,254	239	2,452	728	16	0	112	856			
Huron-Manistee	896	34	3,275	812	5,017	2,062	124	0	0	2,186			
Ottawa	855	0	4,178	1,525	6,558	846	0	0	0	846			
Subtotal	2,546	198	8,707	2,576	14,027	3,636	140	0	112	3,888			

See footnotes at end of table.



Table 25--Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--fiscal year 1988--Continued

State, Commonwealth, or Territory 1/ National Forest	Reforestation					Timber stand improvement				
	Artificial regeneration		Natural regeneration		Total	Release	Thinning	Fertili- zation	Pruning	Total
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/						
Acres										
Minnesota										
Chippewa	1,399	35	6,315	89	7,838	1,383	0	0	10	1,393
Superior	2,303	875	772	0	3,950	1,944	126	0	0	2,070
Subtotal	3,702	910	7,087	89	11,788	3,327	126	0	10	3,463
Mississippi										
NFs in Mississippi (subtotal)	7,985	0	616	0	8,601	1,769	475	0	0	2,244
Missouri										
Mark Twain (subtotal)	1,779	54	6,859	11	8,703	1,393	412	0	0	1,805
Montana										
Beaverhead	293	0	239	118	650	4	273	0	0	277
Bitterroot	3,677	0	123	879	4,679	349	473	0	0	822
Custer	32	0	0	0	32	299	254	0	0	553
Deerlodge	44	0	12	145	201	684	179	0	0	863
Flathead	3,768	86	1,602	1,704	7,160	378	1,270	0	0	1,648
Gallatin	888	3	69	1,198	2,158	0	727	0	0	727
Helena	1,687	0	35	73	1,795	0	340	0	0	340
Idaho Panhandle	0	0	0	17	17	83	88	0	0	171
Kootenai	5,691	148	1,833	1,273	8,945	36	3,844	0	10	3,890
Lewis and Clark	156	0	467	428	1,051	139	441	0	0	580
Lolo	1,059	29	712	531	2,331	0	844	0	0	844
Subtotal	17,295	266	5,092	6,366	29,019	1,972	8,733	0	10	10,715
New Hampshire										
White Mountain (subtotal)	0	0	385	288	673	448	177	0	0	625
New York										
Finger Lakes (subtotal)	0	0	0	0	0	0	30	0	0	30

See footnotes at end of table.

Table 25--Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--fiscal year 1988--Continued

State, Commonwealth, or Territory 1/ National Forest	Reforestation										Timber stand improvement			
	Artificial regeneration		Natural regeneration		Total	Release	Thinning	Ferti- zation	Pruning	Total				
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/										
Acres														
North Carolina														
NFs in North Carolina (sub)	2,130	0	1,891	0	4,021	1,196	550	0	0	0	1,746			
Ohio														
Wayne (subtotal)	441	0	1,104	0	1,545	474	0	0	10	484				
Oklahoma														
Ouachita (subtotal)	2,182	0	15	0	2,197	225	352	0	0	577				
Oregon														
Deschutes	2,856	1,485	25	201	4,567	948	1,185	0	0	2,133				
Fremont	1,412	0	322	329	2,063	0	1,542	0	0	1,542				
Malheur	950	0	0	230	1,180	0	8,884	0	0	8,884				
Mt. Hood	3,229	0	49	519	3,797	10	1,665	2,063	0	3,738				
Ochoco	1,372	0	0	150	1,522	0	0	0	0	0				
Rogue River	3,468	0	0	0	3,468	1,310	149	0	0	1,459				
Siskiyou	1,431	0	0	160	1,591	55	512	597	0	1,164				
Siuslaw	8,473	0	0	0	8,473	3,348	2,626	0	0	5,974				
Umatilla	3,317	0	462	685	4,464	0	309	0	0	309				
Umpqua	4,144	0	0	262	4,406	43	1,721	3,803	0	5,567				
Wallowa-Whitman	2,207	0	201	1,114	3,522	122	398	0	0	520				
Willamette	7,181	0	0	39	7,220	369	10,674	6,255	0	17,298				
Winema	0	0	0	127	127	0	2,467	0	0	2,467				
Subtotal	40,040	1,485	1,059	3,816	46,400	6,205	32,132	12,718	0	51,055				

See footnotes at end of table.



Table 25--Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--fiscal year 1988--Continued

State, Commonwealth, or Territory 1/ National Forest	Reforestation					Timber stand improvement				
	Artificial regeneration		Natural regeneration			Ferti-				
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/	Total	Release	Thinning	zation	Pruning	Total
Acres										
South Dakota										
Black Hills	0	0	104	312	416	0	11,288	0	0	11,288
Custer	0	0	0	0	0	0	15	0	0	15
Subtotal	0	0	104	312	416	0	11,303	0	0	11,303
Tennessee										
Cherokee (subtotal)	1,117	0	774	0	1,891	1,615	117	0	0	1,732
Texas										
NFs in Texas (subtotal)	2,166	0	341	0	2,507	90	990	0	0	1,080
Utah										
Ashley	0	0	1,600	170	1,770	0	0	0	0	0
Dixie	596	0	0	0	596	30	3,487	0	0	3,517
Fishlake	34	0	0	0	34	75	0	0	0	75
Uinta	0	0	60	0	60	66	0	0	0	66
Wasatch-Cache	0	0	200	0	200	0	0	0	0	0
Subtotal	630	0	1,860	170	2,660	171	3,487	0	0	3,658
Vermont										
Green Mountain (subtotal)	50	0	635	0	685	171	61	0	0	232
Virginia										
George Washington	459	0	2,558	18	3,035	889	122	0	0	1,011
Jefferson	913	0	2,361	0	3,274	1,144	1,131	0	0	2,275
Subtotal	1,372	0	4,919	18	6,309	2,033	1,253	0	0	3,286

See footnotes at end of table.

Table 25--Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--fiscal year 1988--Continued

State, Commonwealth, or Territory 1/ National Forest	Reforestation				Timber stand improvement					
	Artificial regeneration		Natural regeneration		Total	Release	Thinning	Fertil- ization	Pruning	Total
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/						
Acres										
Washington										
Colville	0	0	0	196	0	0	0	0	0	0
Gifford Pinchot	7,913	0	107	105	0	4,903	0	285	0	5,188
Idaho Panhandle	38	0	0	27	0	229	0	0	0	229
Mt. Baker-Snoqualmie	2,068	0	156	622	97	2,366	346	0	0	2,809
Okanogan	157	0	405	180	0	267	0	0	0	267
Olympic	6,666	0	33	564	380	2,061	2,002	0	0	4,443
Wenatchee	415	0	12	0	281	1,871	1,142	24	0	3,318
Subtotal	17,257	0	713	1,694	758	11,697	3,490	309	0	16,254
West Virginia										
George Washington	204	0	154	0	33	103	0	0	0	136
Monongahela	197	0	316	0	555	51	0	0	0	606
Subtotal	401	0	470	0	588	154	0	0	0	742
Wisconsin										
Chequamegon	1,198	0	3,267	348	878	0	0	0	0	878
Nicolet	722	0	1,635	3,201	1,293	0	0	0	0	1,293
Subtotal	1,920	0	4,902	3,549	2,171	0	0	0	0	2,171

See footnotes at end of table.



Table 25--Reforestation and timber stand improvement acreages certified as satisfactorily stocked by State and National Forest--  
fiscal year 1988--Continued

State, Commonwealth, or Territory 1/ National Forest	Reforestation					Timber stand improvement				
	Artificial regeneration		Natural regeneration			Fertilization				
	Planted	Seeded	w/site prep. 2/	w/o site prep. 2/	Total	Release	Thinning		Pruning	Total
Acres										
Wyoming										
Big Horn	251	0	0	169	420	0	0	0	0	0
Black Hills	0	0	0	161	161	0	300	0	0	300
Bridger-Teton	0	0	0	0	0	0	293	0	0	293
Medicine Bow	0	0	883	0	883	330	1,633	0	0	1,963
Shoshone	0	0	3,249	0	3,249	0	625	0	0	625
Targhee	103	0	192	0	295	0	0	0	0	0
Subtotal	354	0	4,324	330	5,008	330	2,851	0	0	3,181
Total	163,397	6,878	86,196	36,813	293,284	71,823	129,595	17,437	615	219,470

1/ States not listed had no certification in fiscal year 1988.

2/ w/ site prep. = with site preparation; w/o site prep. = without site preparation.

Table 26—Certification of reforestation and timber stand improvement acreages by Region--fiscal year 1988

Region	Reforestation				Timber stand improvement					
	Planted	Seeded	Natural regeneration		Total	Release	Precom- mercial thinning	Fertili- zation	Pruning	Total
			With site preparation	Without site preparation						
Acres										
Northern	27,498	389	5,870	10,927	44,684	3,734	13,470	0	92	17,296
Rocky Mountain	1,547	116	4,775	7,987	14,425	1,393	14,898	0	0	16,291
Southwest	0	0	0	0	0	0	3,863	0	0	3,863
Intermountain	5,311	0	25,704	801	31,816	3,222	23,218	0	0	26,440
Pacific Southwest	1,137	0	176	47	1,360	9,915	2,223	1	82	12,221
Pacific Northwest	57,259	1,485	1,772	5,483	65,999	6,963	43,600	16,208	309	67,080
Southern	57,861	3,726	15,017	372	76,976	32,637	6,712	1,228	0	40,577
Eastern	12,030	1,162	32,882	6,617	52,691	12,504	997	0	132	13,633
Alaska	754	0	0	4,579	5,333	1,455	20,614	0	0	22,069
Total	163,397	6,878	86,196	36,813	293,284	71,823	129,595	17,437	615	219,470



Table 27--Total recreation use on National Forest System lands by State--fiscal years 1984-88

State, Commonwealth, or Territory 1/	1988	1987	1986	1985	1984
	<i>1,000 RVD's 2/</i>				
Alabama	741.4	850.4	771.0	871.9	1,053.7
Alaska	4,354.5	4,085.3	3,584.6	4,851.7	3,519.6
Arizona	18,831.2	18,839.8	17,451.6	14,664.1	16,376.7
Arkansas	2,358.5	2,278.7	2,213.7	2,206.0	2,251.3
California	59,516.9	57,975.4	55,745.9	55,314.3	55,476.3
Colorado	21,484.0	22,583.3	20,158.7	21,115.7	20,734.9
Florida	2,787.5	2,731.5	2,637.2	2,532.9	2,630.0
Georgia	2,707.0	2,669.4	2,314.5	2,304.0	2,275.6
Idaho	10,736.3	10,806.5	10,342.1	10,220.7	10,505.9
Illinois	891.5	830.0	972.6	972.7	801.4
Indiana	430.1	483.2	425.1	393.1	388.7
Kansas	38.2	21.8	21.0	19.2	16.5
Kentucky	2,301.3	2,248.7	2,162.9	2,152.5	2,090.4
Louisiana	502.3	418.1	475.7	430.8	480.2
Maine	47.6	47.6	46.1	47.5	51.6
Michigan	4,319.6	4,409.8	4,196.7	4,133.6	4,652.5
Minnesota	4,449.6	4,382.3	4,297.5	4,391.9	4,302.5
Mississippi	1,240.4	1,179.5	1,128.3	1,115.8	1,246.0
Missouri	1,705.0	1,716.4	1,693.6	1,761.4	1,706.9
Montana	8,843.7	9,912.3	8,899.8	10,020.7	9,388.1
Nebraska	181.1	163.0	106.8	115.1	129.4
Nevada	2,656.8	2,353.8	2,148.6	2,074.1	2,059.1
New Hampshire	2,783.0	2,474.1	2,259.5	2,374.9	2,286.2
New Mexico	7,227.5	6,446.6	6,015.5	6,975.7	6,416.1
New York	25.6	22.8	23.2	22.9	22.3
North Carolina	4,973.2	4,572.1	4,258.1	3,667.7	4,085.7
North Dakota	186.7	131.3	142.0	135.5	357.5
Ohio	410.7	411.7	381.0	375.6	376.3
Oklahoma	331.4	320.6	357.0	377.2	398.8
Oregon	19,598.1	19,210.1	19,294.9	19,060.6	20,139.5
Pennsylvania	2,621.4	2,394.1	2,067.6	1,948.9	2,000.8
Puerto Rico	399.7	382.2	539.1	468.5	530.2
South Carolina	916.5	920.0	845.1	919.3	1,004.1
South Dakota	2,734.9	2,687.4	2,692.4	3,495.4	2,556.1
Tennessee	2,561.7	2,432.2	2,170.4	2,107.2	2,525.2
Texas	1,863.6	1,923.9	1,958.7	1,623.1	1,965.2
Utah	14,454.8	13,736.9	13,179.4	13,914.3	13,621.1
Vermont	1,154.1	1,029.1	11,142.9	850.5	609.2
Virginia	3,804.0	3,726.4	3,498.7	3,511.2	3,516.4
Washington	15,477.6	15,058.3	14,863.9	12,690.2	13,986.8
West Virginia	1,152.1	1,137.2	1,265.6	1,334.0	1,370.4
Wisconsin	2,000.1	1,952.5	1,909.8	1,942.8	1,928.9
Wyoming	6,514.5	6,502.0	5,873.9	5,902.1	5,719.8
Total	242,315.7	238,458.3	236,532.7	225,407.3	227,553.9

1/ States not listed have no Forest Service recreation program.

2/ One recreation visitor-day (RVD) is the recreation use of National Forest land or water that aggregates 12 visitor-hours. This may entail 1 person for 12 hours, 12 persons for 1 hour, or any equivalent combination of individual or group use, either continuous or intermittent.

**Table 28—State summary of total recreation use on National Forest System lands by activity--fiscal year 1988**

State, Commonwealth, or Territory 1/	Camping, picnicking & swimming	Mechanized travel & viewing scenery	Hiking, horseback riding & water travel	Winter sports	Resorts, cabins & organization camps
			1,000 RVD's 2/		
Alabama	222	89	78	0	1
Alaska	317	2,761	306	111	126
Arizona	5,788	8,031	1,400	232	921
Arkansas	701	529	170	0	16
California	17,790	20,459	3,993	3,459	6,768
Colorado	4,936	6,244	1,634	5,288	614
Florida	1,546	408	151	0	209
Georgia	806	820	305	2	43
Idaho	3,323	2,923	994	565	586
Illinois	221	314	129	1	1
Indiana	198	51	54	0	0
Kansas	9	17	2	0	0
Kentucky	622	752	316	2	17
Louisiana	181	124	11	0	32
Maine	15	6	9	1	2
Michigan	1,117	1,553	296	82	88
Minnesota	1,243	888	466	206	384
Mississippi	309	264	118	0	5
Missouri	505	489	211	0	11
Montana	1,970	2,495	1,125	538	336
Nebraska	61	42	16	0	29
Nevada	742	536	188	241	120
New Hampshire	696	840	484	578	86
New Mexico	2,510	1,629	673	609	226
New York	10	3	3	2	0
North Carolina	1,271	1,698	730	14	79
North Dakota	13	31	10	3	1
Ohio	85	109	51	1	0
Oklahoma	55	152	27	0	0
Oregon	6,234	5,798	1,738	891	1,241
Pennsylvania	717	691	161	7	72
Puerto Rico	159	129	38	0	16
South Carolina	244	270	125	0	1
South Dakota	216	1,962	104	15	115
Tennessee	1,011	706	277	2	103
Texas	584	251	54	0	9
Utah	5,612	3,497	1,214	940	726
Vermont	120	173	57	650	52
Virginia	997	1,162	376	17	19
Washington	4,457	4,669	1,220	919	1,758
West Virginia	435	183	102	4	21
Wisconsin	521	644	85	16	23
Wyoming	1,617	1,680	937	393	590
Total	70,186	76,071	20,432	15,785	15,445

1/ States not listed have no Forest Service recreation program.

2/ One recreation visitor-day (RVD) is the recreation use of National Forest land or water that aggregates 12 visitor-hours. This may entail 1 person for 12 hours, 12 persons for 1 hour, or any equivalent combination of individual or group use, either continuous or intermittent.



Table 28--State summary of total recreation use on National Forest System lands  
by activity--fiscal year 1988--Continued

Hunting	Fishing	Nature studies <i>1,000 RVD's 2/</i>	Other recreation activities	Total	State, Commonwealth, or Territory 1/
242	72	12	27	741	Alabama
146	407	24	157	4,355	Alaska
715	748	109	888	18,831	Arizona
513	294	22	112	2,359	Arkansas
1,515	3,086	415	2,033	59,517	California
969	1,174	82	544	21,484	Colorado
206	159	16	93	2,788	Florida
381	250	33	68	2,707	Georgia
829	781	57	679	10,736	Idaho
114	49	17	46	892	Illinois
40	73	3	12	430	Indiana
6	3	2	1	38	Kansas
184	277	30	101	2,301	Kentucky
97	24	2	32	502	Louisiana
8	4	1	1	48	Maine
526	427	19	214	4,320	Michigan
320	778	18	147	4,450	Minnesota
385	84	17	59	1,240	Mississippi
277	106	18	88	1,705	Missouri
917	723	54	686	8,844	Montana
10	1	0	22	181	Nebraska
197	105	53	476	2,657	Nevada
35	26	13	24	2,783	New Hampshire
564	330	75	612	7,228	New Mexico
6	1	0	1	26	New York
657	308	54	161	4,973	North Carolina
123	3	1	2	187	North Dakota
114	22	4	25	411	Ohio
62	19	1	16	331	Oklahoma
1,325	1,016	307	1,048	19,598	Oregon
595	311	16	53	2,621	Pennsylvania
0	0	2	57	400	Puerto Rico
164	44	10	60	917	South Carolina
153	69	7	94	2,735	South Dakota
220	165	21	56	2,562	Tennessee
201	739	8	18	1,864	Texas
989	891	104	481	14,455	Utah
49	9	3	41	1,154	Vermont
684	324	47	178	3,804	Virginia
870	590	120	874	15,478	Washington
221	119	5	64	1,152	West Virginia
215	386	53	58	2,000	Wisconsin
572	460	42	224	6,515	Wyoming
16,416	15,454	1,897	10,631	242,316	Total

Table 29--Trail miles on the National Forest System by State--fiscal years 1986-88 1/

State, Commonwealth, or Territory 2/	1988			1987			1986		
	Total	Constructed	3/ Maintained	Total	Constructed	3/ Maintained	Total	Constructed	3/ Maintained
Alabama	244	8	138	236	7	117	230	0	96
Alaska	948	12	354	656	28	629	700	6	545
Arizona	3,899	44	360	3,817	22	333	3,546	7	1,800
Arkansas	518	15	332	400	12	150	515	1	145
California	12,443	189	5,204	11,839	222	6,493	11,030	150	6,264
Colorado	8,734	221	2,784	8,288	97	4,135	8,288	226	4,595
Florida	269	2	180	267	0	162	267	0	126
Georgia	535	8	458	527	7	231	523	0	320
Idaho	16,931	152	7,508	16,316	108	8,238	16,316	80	6,887
Illinois	206	0	206	205	0	205	205	0	205
Indiana	120	0	80	120	0	62	142	0	90
Kentucky	544	4	266	542	4	187	540	8	195
Louisiana	127	0	69	127	13	88	114	0	41
Maine	116	4	116	108	0	108	108	0	108
Michigan	2,461	93	1,713	2,091	46	1,776	2,076	54	1,537
Minnesota	2,698	45	2,645	2,651	4	2,647	2,624	23	2,415
Mississippi	396	4	127	392	6	104	392	3	87
Missouri	623	14	537	603	0	568	603	10	568
Montana	12,820	93	4,676	12,820	68	6,488	12,818	93	6,196
Nebraska	52	2	1	39	1	22	39	1	24
Nevada	1,647	1	481	1,523	5	315	1,523	26	361
New Hampshire	1,283	47	1,083	1,275	5	1,275	1,275	0	1,364
New Mexico	3,654	28	1,596	3,511	12	964	3,098	18	1,500
New York	32	7	32	25	0	25	25	0	25
North Carolina	1,408	26	810	1,463	8	777	1,457	1	732
Ohio	134	35	75	122	12	99	122	5	104
Oklahoma	82	0	30	82	0	30	82	0	0
Oregon	8,807	293	5,284	8,514	99	5,028	7,253	90	4,893
Pennsylvania	428	15	428	428	75	355	355	0	342
Puerto Rico	21	1	21	31	1	25	31	1	12
South Carolina	533	15	212	520	12	180	516	0	132
South Dakota	176	13	10	138	3	123	138	3	137
Tennessee	592	15	582	582	6	161	576	0	162
Texas	208	15	161	193	10	190	183	8	125

See footnotes at end of table



Table 29--Trail miles on the National Forest System by State--fiscal years 1986-88--Continued

State, Commonwealth, or Territory 2/	1988			1987			1986		
	Total	Constructed	3/ Maintained	Total	Constructed	3/ Maintained	Total	Constructed	3/ Maintained
Utah	5,075	75	2,203	5,060	24	2,143	5,009	100	2,652
Vermont	670	23	670	594	6	550	588	2	613
Virginia	1,871	14	1,039	1,867	12	393	1,865	20	380
Washington	7,239	197	4,488	7,042	65	4,431	6,998	142	4,529
West Virginia	863	69	269	837	0	233	837	0	305
Wisconsin	1,348	7	1,056	1,343	7	1,343	1,335	0	841
Wyoming	6,079	28	2,121	5,313	39	2,303	5,419	14	3,268
Total	106,834	1,834	50,405	102,507	1,046	53,686	99,761	1,092	54,721

1/ Includes work accomplished by Human Resource Programs and volunteers.

2/ States not listed have no Forest Service recreation program.

3/ Miles constructed include construction of new trails and reconstruction of existing trails. The predominant activity is reconstruction.

**Table 30—Acres of the National Wilderness Preservation System by State--  
calendar years 1984-88 1/**

State, Commonwealth, or Territory 2/	1988	1987	1986	1985	1984
	<i>1,000 acres 3/</i>				
Alabama	33	19	19	19	19
Alaska	5,453	5,453	5,453	5,453	5,453
Arizona	1,338	1,316	1,316	1,320	1,320
Arkansas	115	115	116	116	116
California	3,921	3,922	3,920	3,920	3,920
Colorado	2,587	2,587	2,584	2,586	2,586
Florida	73	73	73	73	73
Georgia	89	89	89	47	47
Idaho	3,960	3,960	3,957	3,827	3,827
Indiana	13	13	13	13	13
Kentucky	17	17	18	18	5
Louisiana	9	9	9	9	9
Michigan	92	92	0	0	0
Minnesota	798	798	798	798	798
Mississippi	6	6	5	5	5
Missouri	63	63	63	63	63
Montana	3,372	3,372	3,371	3,366	3,366
Nebraska	8	8	8	0	0
Nevada	65	65	65	65	65
New Hampshire	103	103	103	103	103
New Mexico	1,388	1,388	1,391	1,387	1,387
North Carolina	101	101	101	100	100
Oklahoma	14	0	0	0	0
Oregon	2,078	2,078	2,078	2,077	2,077
Pennsylvania	9	9	10	10	10
South Carolina	17	17	17	17	17
South Dakota	10	10	10	10	10
Tennessee	67	67	67	33	33
Texas	36	36	35	34	34
Utah	775	775	780	780	780
Vermont	59	59	59	59	59
Virginia	90	65	65	65	65
Washington	2,571	2,571	2,573	2,521	2,521
West Virginia	81	78	78	78	78
Wisconsin	42	42	44	44	44
Wyoming	3,081	3,081	3,081	3,086	3,086
Total	32,534	32,457	32,369	32,102	32,089

1/ Includes all changes to the Wilderness Preservation System through the 100th Congress.

2/ States not listed have no National Forest System acres in the National Wilderness Preservation System.

3/ Acreage for most states is estimated pending final map compilation; therefore, minor changes may occur between years.



Table 31--Additions to the National Wilderness Preservation System--fiscal year 1988 1/

Public Law	State	Date	Number of new areas	Number of additions	Number of adjustments	Acres
100-499	Oklahoma	10/18/88	2	0	0	13,945
100-547	Alabama	10/28/88	0	2	0	13,970
100-326	Virginia & West Virginia	1/25/88	4	2	0	27,687
Total			6	4	0	55,602

1/ Includes all changes to the Wilderness Preservation System through the 100th Congress.

**Table 32--Additions to the National Wild and Scenic Rivers System--  
fiscal year 1988 1/**

River	State	Date	Miles
Wildcat Creek	New Hampshire	10/28/88	14.5
Sipsey Fork of the West Fork	Alabama	10/28/88	61.4
Big Marsh Creek	Oregon	10/28/88	15
Chetco	Oregon	10/28/88	44.5
Clackamas	Oregon	10/28/88	47
Crescent Creek	Oregon	10/28/88	10
Deschutes	Oregon	10/28/88	54.4
Eagle Creek	Oregon	10/28/88	27
Elk	Oregon	10/28/88	19
Grande Ronde	Oregon	10/28/88	18.9
Imnaha	Oregon	10/28/88	77
Joseph Creek	Oregon	10/28/88	8.6
Little Deschutes	Oregon	10/28/88	12
Lostine	Oregon	10/28/88	16
Malheur	Oregon	10/28/88	13.7
McKenzie	Oregon	10/28/88	12.7
Metolius	Oregon	10/28/88	28.6
Minam	Oregon	10/28/88	39
North Fork Crooked	Oregon	10/28/88	14.7
North Fork John Day	Oregon	10/28/88	54.1
North Fork Malheur	Oregon	10/28/88	25.5
North Fork of the Middle Fork Willamette	Oregon	10/28/88	42.3
North Fork Smith	Oregon	10/28/88	13
North Fork Sprague	Oregon	10/28/88	15
North Powder	Oregon	10/28/88	6
North Umpqua	Oregon	10/28/88	25.4
Roaring	Oregon	10/28/88	13.7
Salmon	Oregon	10/28/88	25.5
Sandy	Oregon	10/28/88	12.4
Squaw Creek	Oregon	10/28/88	15.4
Sycan	Oregon	10/28/88	59
Upper Rogue	Oregon	10/28/88	40.3
Wenaha	Oregon	10/28/88	21.6
White	Oregon	10/28/88	22.1
Rio Chama	New Mexico	11/7/88	3.1
Total			928.4

1/ Includes all rivers added to the National Wild and Scenic Rivers System through the 100th Congress.



Table 33--Wildlife and fish habitat improvement by Region--fiscal year 1988 1/

Region	Wildlife	Resident & anadromous fish	Threatened, endangered & sensitive species	Total
Northern				
Acres	8,417	375	1,475	10,267
Structures	50	307	8	365
Rocky Mountain				
Acres	20,297	54	94	20,445
Structures	231	544	48	823
Southwestern				
Acres	11,683	44	11,448	23,175
Structures	297	372	62	731
Intermountain				
Acres	13,803	264	137	14,204
Structures	108	236	16	360
Pacific Southwest				
Acres	12,220	296	787	13,303
Structures	135	355	46	536
Pacific Northwest				
Acres	8,840	248	152	9,240
Structures	333	2,107	96	2,536
Southern				
Acres	22,071	2,789	12,185	37,045
Structures	790	544	31	1,365
Eastern				
Acres	18,997	2,752	2,803	24,552
Structures	2,289	1,818	259	4,366
Alaska				
Acres	1,660	200	0	1,860
Structures	119	13	0	132
Total				
Acres	117,988	7,022	29,081	154,091
Structures	4,352	6,296	566	11,214

1/ Does not include activities that are accomplished in support of other resource programs.

Table 34--Range allotment management status by Region--fiscal year 1988

Region	Number of allotments			Acres	
	Total	Improved management started	Improved management maintained	Total	Suitable 1/
Northern	1,722	11	1,332	11,152,259	4,083,055
Rocky Mountain	2,450	43	1,904	18,810,916	8,375,255
Southwestern	1,422	68	1,123	21,878,612 2/	13,193,712 2/
Intermountain	1,890	3	1,471	26,817,298	11,378,698
Pacific Southwest	811	47	580	11,679,823	4,649,063
Pacific Northwest	810	21	482	11,743,603	7,219,517
Southern	566	0	426	1,707,679	1,225,926
Eastern	197 2/	2 2/	155 2/	95,645 2/	47,129 2/
Total	9,868	195	7,473	103,885,835	50,172,355

1/ Suitable acres are acres accessible to livestock and which can be grazed on a sustained yield basis without damage to the resource.

2/ FY 1987 data.

Table-35 Range allotment management status--fiscal years 1984-88

	Unit of measure	1988	1987	1986	1985	1984
Total allotments 1/		9,868	9,610	9,658	10,223	10,296
Improved management started	Allotments	195	225	338	351	471
Improved management maintained	Allotments	7,473	7,335	7,503	7,237	7,018
Total acres	MM acres	104	100	103	105	105
Suitable acres	MM acres	50	50	50	50	51
Permitted use 2/	MM AUM's	9.9	9.9	10.1	10.1	10.1
Actual use	MM AUM's	8.4	8.4	8.7	8.8	8.8

1/ Does not include vacant allotments.

2/ An animal unit month (AUM) is the amount of forage required by a 1,000-pound cow or the equivalent for 1 month.

Table 36—Actual grazing use by State--fiscal year 1988

State, Commonwealth, or Territory 1/	Cattle	Sheep	Domestic horses	Wild horses	Wild burros	Total
Alabama	1,296	0	48	0	0	1,344
Arizona	1,096,539	13,224	8,493	0	346	1,118,602
Arkansas	45,242	0	72	0	0	45,314
California	471,078	53,155	12,609	7,290	785	544,917
Colorado	759,894	128,881	15,670	0	0	904,445
Florida	7,220	0	0	0	0	7,220
Georgia	5,208	0	0	0	0	5,208
Idaho	564,058	164,687	9,514	0	0	738,259
Illinois	17,490	3,018	43	0	0	20,551
Kansas	39,690	0	43	0	0	39,733
Kentucky	91	0	0	0	0	91
Louisiana	22,339	0	8	0	0	22,347
Michigan	1,720	0	0	0	0	1,720
Minnesota	2,073	0	0	0	0	2,073
Mississippi	12,851	0	0	0	0	12,851
Missouri	30,484	0	16	0	0	30,500
Montana	543,040	16,932	17,234	0	0	577,206
Nebraska	116,618	0	149	0	0	116,767
Nevada	300,477	56,829	1,978	3,997	0	363,281
New Mexico	779,920	27,640	7,669	650	0	815,879
New York	9,300	0	24	0	0	9,324
North Dakota	492,108	254	4,002	0	0	496,364
Ohio	869	0	0	0	0	869
Oklahoma	24,547	0	26	0	0	24,573
Oregon	418,971	25,806	3,226	3,024	0	451,027
South Carolina	209	0	0	0	0	209
South Dakota	434,256	6,907	689	0	0	441,852
Texas	119,256	0	123	0	0	119,379
Utah	472,521	200,793	1,505	0	0	674,819
Vermont	267	0	1	0	0	268
Virginia	5,436	0	362	0	0	5,798
Washington	90,686	11,808	3,607	0	0	106,101
West Virginia	9,121	219	36	0	0	9,376
Wisconsin	43	0	0	0	0	43
Wyoming	528,822	149,633	12,090	0	0	690,545
Total	7,423,740	859,786	99,237	14,961	1,131	8,398,855

1/ States not listed had no Forest Service grazing program in 1988.

2/ An animal unit month (AUM) is the amount of forage required by a 1,000-pound cow, or the equivalent for 1 month.



Table 37--Annual grazing statistics--fiscal year 1988

	Permittees		Cattle		Horses and burros		Sheep and goats		Total	
	Number	AUM's	1/ Number	AUM's	Number	AUM's	Number	AUM's	Number	AUM's
Permitted to graze	1,434,917	8,633,592	88,045	104,247	1,363,048	1,133,883	2,886,010	9,871,722		
Actually grazed: Paid permits	13,737 2/	1,270,182	7,390,794	14,900	50,490	1,028,943	854,907	2,314,025	8,296,191	
Free use:										
Recreation stock	35,529	333	74	38,724			74,823	38,798		
Other free use	152	2,821	20,387	9,913	979	3,142	4,837	33,442		
Private land permits 3/	(496)	(69,215)	(470,087)	(385)	(20,388)	(21,500)	(89,988)	(497,672)		
Crossing	40	19,597	2,329	32	21,401	1,678	41,022	4,039		
Unauthorized use	31	2,766	10,156	28	78	59	2,863	10,293		
Total 3/	49,489	1,295,699	7,423,740	90,479	99,237	1,051,392	859,786	2,437,570	8,382,763	
Wild horses			1,182	14,961			1,182	14,961		
Wild burros			195	1,131			195	1,131		
Total actually grazed 3/	49,489	1,295,699	7,423,740	91,856	115,329	1,051,392	859,786	2,438,947	8,398,855	

1/ An animal unit month (AUM) is the amount of forage required by a 1,000-pound cow, or the equivalent for 1 month.

2/ Includes term and temporary grazing permits and all other paid permits (e.g., transportation, research, working animals, special uses, etc.).

3/ Private land permit data not included in totals.

Table 38--Range improvements by type--fiscal year 1988

Improvement type	Unit of measure	Units of construction completed	Total cost <i>Actual dollars</i>
Structural:			
Water developments	Sites	1,426	1,694,692
Range fence	Miles	1,331	3,065,273
Pipeline	Miles	145	493,213
Other structural facilities	Sites	311	462,773
Subtotal		- 1/	5,715,951
Nonstructural:			
Cover manipulation, brush	Acres	31,641	467,527
Range plant control	Acres	7,443	244,203
Forage improvement	Acres	49,401	655,744
Noxious farm weed control	Acres	22,158	902,545
Subtotal		110,644	2,270,019
Total		- 1/	7,985,970

1/ -- = not applicable.

Table 39—Road and bridge construction and reconstruction by State--fiscal year 1988

State, Commonwealth, or Territory 1/	From appropriated funds			By timber purchasers		
	Roads	Bridges	Cost 2/	Roads	Bridges	Cost
	Miles	Number	1,000 dollars	Miles 3/	Number	1,000 dollars
Alabama	7.3	1	2,161.7	40.1	0	723.1
Alaska	7.4 4/	0 4/	1,368.9 4/	99.8	0	3,295.4
Arizona	27.8	0	6,299.1	255.0	0	1,154.6
Arkansas	25.6	0	2,664.4	152.5	0	1,603.5
California	218.7	3	22,079.6	740.9	0	17,602.1
Colorado	105.0	1	7,000.2	58.5	0	862.2
Florida	0.1	0	757.8	63.5	0	886.1
Georgia	11.2	5	3,222.8	15.7	0	253.1
Idaho	89.2	6	14,160.0	656.1	0	8,960.8
Illinois	4.0	2	929.6	8.8	0	86.0
Kentucky	7.5	0	979.3	32.7	0	306.8
Louisiana	31.6	3	2,215.9	46.5	0	745.5
Maine	0.1	0	125.5	0.5	0	4.1
Michigan	27.3	1	2,603.5	52.1	0	352.2
Minnesota	17.4	0	2,119.4	27.8	0	263.4
Mississippi	0.0	0	1,014.0	105.7	0	1,206.4
Missouri	37.9	0	940.4	35.7	0	151.9
Montana	204.3	3	18,737.8	331.0	0	3,455.2
Nebraska	4.4	0	38.4	0.0	0	0.0
Nevada	0.0	0	160.4	0.0	0	0.0
New Hampshire	0.1	1	441.8	2.4	0	31.9
New Mexico	33.9	0	4,582.8	151.7	0	1,742.1
North Carolina	65.2	1	2,484.3	54.0	0	755.4
Ohio	3.4	0	366.4	3.8	0	43.3
Oklahoma	0.1	0	34.1	2.5	0	43.5
Oregon	227.0	5	41,340.0	1,433.0	0	39,260.0
Pennsylvania	0.0	0	764.7	49.2	0	709.3
Puerto Rico	0.0	0	70.4	0.0	0	0.0
South Carolina	0.2	4	745.4	89.5	0	1,148.2
South Dakota	9.7	2	1,509.4	100.1	0	1,254.2
Tennessee	10.6	0	1,068.6	24.6	0	168.5
Texas	11.3	1	928.9	19.4	0	325.2
Utah	14.3	0	3,890.6	90.0	0	306.3
Vermont	0.6	1	347.4	1.9	0	31.2
Virginia	26.4	5	2,407.0	68.0	0	428.3
Washington	66.0	14	18,260.0	503.0	0	13,837.0
West Virginia	6.7	1	884.2	12.4	0	363.1
Wisconsin	25.3	1	3,508.1	19.6	0	163.8
Wyoming	24.6	2	2,401.1	92.3	0	1,256.9
Total	1,352.2	63	175,613.9 5/	5,440.3	0	103,780.6

1/ States not listed had no Forest Service road programs in 1988.

2/ Includes funds for engineering and program support for appropriated roads and timber purchaser roads.

3/ Does not include 290.3 miles turned back to Forest Service for construction.

4/ Does not include Tongass Timber Supply Fund, \$17,507,400, 39.4 miles, and 65 bridges.

5/ Does not include \$5,741,542 of Washington Office funds and \$440,000 transferred to the Federal Highway Administration (FHWA). The FHWA funds provided for A&E planning and design for future year projects.



**Table 40—Timber purchaser roads constructed by the Forest Service  
by State--fiscal year 1988**

State or Commonwealth 1/	Roads constructed	Cost
	<i>Miles</i>	<i>1,000 dollars</i>
Alabama	0.0	116.3
Arizona	9.2	130.7
Arkansas	4.8	123.6
Colorado	5.8	80.6
Florida	0.0	5.7
Georgia	0.9	59.6
Idaho	90.7	816.5
Illinois	5.0	94.8
Louisiana	11.5	177.8
Montana	18.0	186.1
New Hampshire	3.2 2/	73.3
New Mexico	3.1	18.3
North Carolina	2.9	47.1
Ohio	0.8	10.3
Oregon	69.0	1,488.0
Pennsylvania	2.6	35.9
South Carolina	3.0	61.6
South Dakota	34.8	243.6
Tennessee	0.0	78.9
Texas	4.5	96.3
Utah	0.0	39.5
Vermont	0.0 2/	26.5
Virginia	2.5	30.1
Washington	18.0	350.0
West Virginia	0.0	1.8
<b>Total</b>	<b>290.3</b>	<b>4,392.9</b>

1/ States not listed had no timber purchaser roads constructed by the Forest Service in 1988.

2/ Includes one bridge.

Table 41--State and Private Forestry funding--fiscal year 1988 compared to 1984-88 average

	1988			1984-88 average	Percent of actual to average
	Actual	RPA low bound	RPA high bound		
1,000 constant 1988 dollars					
Appropriated accounts					
Forest pest mangement	44,441	19,222	38,721	35,620	124.76
Fire protection	13,770	3,500	17,834	14,458	95.24
Forest management and utilization	10,783	0	22,353	10,979	98.22
Special projects	10,875	2,883	3,176	6,640	163.79
Subtotal	79,869	25,605	82,084	67,697	117.98
Transfer accounts					
Rural community fire protection	3,091	– 1/	–	2,708	114.14
Watershed and flood prevention	2,777	–	–	5,524	50.28
Watershed planning	241	–	–	247	97.68
Resource conservation and development	803	–	–	786	102.11
River basin surveys and investigations	852	–	–	1,082	78.73
Forestry Incentives Program 2/	1,189	–	–	1,304	91.18
Agricultural Conservation Program 2/	1,769	–	–	1,964	90.08
Subtotal	10,722	–	–	13,615	78.75
Total	90,591	25,605	82,084	81,311	111.41

1/ -- = not reported in the RPA.

2/ Includes only technical assistance allocated for the Forestry Incentives and Agricultural Conservation Programs (administered jointly by ASCS and FS).

Table 42—State and Private Forestry funding--fiscal years 1984-88

	1988	1987	1986	1985	1984
	<i>1,000 dollars</i>				
Appropriated accounts					
Forest pest management	44,441	38,462	28,329	28,825	29,179
Fire protection	13,770	13,661	13,032	13,739	14,016
Forest management and utilization	10,783	10,026	9,518	10,756	10,713
Special projects	10,875	4,405	4,442	4,972	6,845
Subtotal	79,869	66,554	55,321	58,292	60,753
Transfer accounts					
Rural community fire protection	3,091	3,091	3,110	3,250	3,250
Watershed and flood prevention	2,777	3,884	3,948	3,580	3,670
Watershed planning	241	211	221	240	250
Resource conservation and development	803	643	693	802	768
River basin surveys and investigations	852	869	1,040	1,117	1,229
Forestry Incentives Program 1/	1,189	1,218	1,196	1,250	1,250
Agricultural Conservation Program 1/	1,769	1,800	1,818	1,900	1,900
Subtotal	10,722	11,716	12,026	12,139	12,317
Total	90,591	78,270	67,347	70,431	73,070

1/ Includes only technical assistance allocated for the Forestry Incentives and Agricultural Conservation Programs (administered jointly by ASCS and FS.)



Table 43--Summary of State and Private Forestry accomplishments compared to funded output levels and to RPA--fiscal year 1988

	Unit of measure	1988			1984-88		1988		RPA	
		Funded	Accomplished	Percent of funded	average accomplishment	as percent of 5-year average				
							Low bound	High bound		
Appropriated accounts										
Forest pest management 2/										
Insect and disease management surveys	MM acres	554	593.0	107	590.0	100.5	170	466		
Insect and disease suppression	MM acres	-- 3/	1.7	--	1.1	154.5	--	--		
Insect and disease special projects	Projects	25	25.0	100	29.8	83.9	--	--		
Forest management and utilization										
Forest resource management										
Forest land management plans	MM acres	3.2	4.0	125	3.9	102.6	2	4		
Timber harvested	MM cubic feet	--	234.9	--	266.0	88.3	--	--		
Reforestation 4/	M acres	--	1,409.4	--	871.7	161.7	323	697		
Timber stand improvement 5/	M acres	--	259.8	--	279.2	93.1	156	373		
Woodland owners assisted	M owners	--	167.4	--	149.9	111.7	--	--		
Wood utilization	MM cubic feet	--	--	--	--	--	64	133		
Seedling, nursery, and tree improvement	MM seedlings	817	1,505.2	184	901.1	167.0	--	--		
Urban forestry assistance	Areas assisted	--	4,990.0	--	4,818.6	103.6	--	--		
Management improvement										
State forest resource planning	Person Years	--	28.0	--	6/	6/	44	46		
Transfer accounts										
Rural community fire protection, FmHA										
Watershed and flood prevention, SCS 8/	M approved applications	3.8	3.8	100	3.0	115.3	--	--		
Watershed planning, SCS	Projects	81	81.0	100	80.8	100.2	--	--		
Resource conservation and development, SCS	Plans	79	63.0	80	63.2	99.7	--	--		
River basin surveys and investigations, SCS	Projects	54	54.0	100	49.0	110.2	--	--		
Forestry Incentives Program, ASCS 7/	Plans	47	49.0	104	43.6	112.4	--	--		
Reforestation	M acres	--	121.2	--	153.8	78.8	--	--		
Timber stand improvement	M acres	--	24.7	--	29.2	65.7	--	--		
Agricultural Conservation Program, ASCS 7/										
Reforestation	M acres	--	98.1	--	80.1	122.5	--	--		
Timber stand improvement	M acres	--	26.6	--	22.7	117.4	--	--		

1/ M = thousand, MM = million.

2/ Includes accomplishments on National Forest System and other Federal lands, as well as State and private.

3/ -- = not applicable.

4/ Includes Conservation Reserve Program, Forestry Incentives Program and Agricultural Conservation Program accomplishments.

5/ Includes Forestry Incentives Program and Agricultural Conservation Program accomplishments.

6/ Not reported due to change in unit of measure from MM acres to person years.

7/ Accomplishments for 1988 are estimates; actual data is not available from ASCS.

8/ Includes Emergency Watershed Protection.

Table 44—Pesticide use report--fiscal year 1988

Common name	Target pest or purpose	Quantity used Pounds 2/	Units treated 1/
Herbicides:			
Amitrole	Noxious weed control	30.00	15
Ammonium sulfamate	Wildlife habitat improvement	1,999.00	525
Arsenal 3/	Conifer release	418.65	741
	General weed control	65.00	52
	Rights-of-way	10.00	10
	Site preparation	118.25	218
Asulam	Rights-of-way	121.00	36
Atrazine	General weed control	216.00	127
	Range management	24.00	20
Bifenox	Nursery weed control	10.00	15
Bromacil/	Firebreak management	8.00	3
Diuron		8.00	
	General weed control	7.70	2
		7.70	
	Rights-of-way	24.00	10
		24.00	
Copper sulfate	Aquatic weed control	28.80	9
Dacthal 3/	Nursery weed control	623.50	150
Dicamba	Conifer release	120.00	35
	Noxious weed control	230.50	334
	Poisonous plant control	10.00	40
	Range management	2.00	8
	Rights-of-way	4.00	30
	Site preparation	1,475.00	923
Diphenamid	Nursery weed control	680.00	183
Diquat	Aquatic weed control	0.20	4
Diuron	General weed control	6.00	4
	Rights-of-way	3.00	1
Diuron/	Rights-of-way	19.20	24
Hexazinone		16.80	
Oust/ 3/		12.00	
Metsulfuron methyl		3.00	
Fosamine ammonium	Noxious weed control	4.00	20
	Rights-of-way	2,693.00	638
	Wildlife habitat improvement	100.00	19
Glyphosate	Aquatic weed control	400.00	150
	Conifer release	5,442.25	4,362
	General weed control	923.72	949
	General weed control	0.62	1,300 seedlings
	General weed control	1.53	16,850 square feet
	Hardwood release	2.00	1
	Noxious weed control	1,169.85	1,236
	Nursery weed control	666.00	83
	Nursery weed control	24.00	25
	Poisonous plant control	5.04	83
	Range management	107.00	99

See footnotes at end of table

Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used	Units treated 1/
		Pounds 2/	
Herbicides: (Cont.)			
Glyphosate	Research	90.00	30
	Rights-of-way	228.00	211
	Rights-of-way	45.00	10 side miles
	Site preparation	3,891.12	4,067
	Wildlife habitat improvement	732.55	708
Glyphosate/ Oust 3/	Rights-of-way	15.00	20 side miles
		1.10	
	Site preparation	23.50	47
Glyphosate/ Triclopyr		11.75	
	Site preparation	33.00	113
Hexazinone		33.00	
	Aquatic weed control	52.00	37
	Conifer release	22,427.20	14,029
	General weed control	32.00	16
	Hardwood release	21.00	31
	Noxious weed control	75.00	5
	Range management	60.00	230
	Site preparation	37,003.75	16,023
	Wildlife habitat improvement	860.00	487
	Linuron	General weed control	8.50
Maleic hydrazide	Rights-of-way	220.00	60
MCPA	Rights-of-way	4.00	1
Mefluidide	Rights-of-way	9.00	63
Metsulfuron methyl	Poisonous plant control	4.50	6
	Rights-of-way	4.75	38
Mineral spirits	Rights-of-way	12.00	2
MSMA	Noxious weed control	5.00	3
	Rights-of-way	628.00	166
Napropamide	Nursery weed control	104.50	43
Oryzalin	Rights-of-way	118.00	24
Oust 3/	Conifer release	529.76	3,367
	General weed control	0.02	3
	Noxious weed control	5.38	165
	Rights-of-way	6.98	92
	Site preparation	160.50	577
Oxyflourfen	Nursery weed control	153.00	71
Pendimethalin	Site preparation	60.00	20
Picloram	Conifer release	1.25	3
	Noxious weed control	2,726.58	5,945
	Noxious weed control	1.18	10,500 square feet
	Poisonous plant control	211.25	267
	Range management	34.00	229
	Rights-of-way	48.00	35
	Site preparation	110.00	64
	Wildlife habitat improvement	218.00	181

See footnotes at end of table.



Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used Pounds 2/	Units treated 1/
Herbicides: (Cont.)			
Picloram/	Rights-of-way	10.00	12
Fosamine ammonium		11.20	
Picloram/	Rights-of-way	45.00	181
Triclopyr		134.00	
Pronamide	Noxious weed control	82.00	21
Sethoxydim	General weed control	1.50	1
	Nursery weed control	34.20	78
Simazine	Aquatic weed control	29.00	4
	Aquatic weed control	10.00	1 acre feet
	General weed control	18.00	6
	Rights-of-way	40.00	9
Simazine/	General weed control	140.00	4,880 square feet
Sodium chlorate		140.00	
Sodium metaborate tetra	Rights-of-way	36.00	24
Tebuthiuron	Noxious weed control	33.50	48
	Range management	706.00	1,330
	Rights-of-way	70.00	9
	Wildlife habitat improvement	822.00	660
Telar 3/	Rights-of-way	2.92	134
Triclopyr	Conifer release	19,221.96	10,287
	Firebreak management	702.00	301
	General weed control	6.00	7
	Hardwood release	2,196.00	1,320
	Poisonous plant control	14.00	6
	Rights-of-way	1,034.00	522
	Rights-of-way	84.00	32 side miles
	Site preparation	16,952.49	15,276
	Thinning	573.00	439
	Wildlife habitat improvement	1,635.00	1,664
2,4-D	Aquatic weed control	9.00	4 acre feet
	Conifer release	1,888.00	403
	General weed control	2.00	3
	Hardwood release	60.80	20
	Noxious weed control	3,217.19	3,400
	Nursery weed control	233.00	112
	Poisonous plant control	177.00	204
	Range management	2,028.00	1,086
	Rights-of-way	1,865.00	599
	Rights-of-way	95.00	55 side miles
	Site preparation	2,343.00	1,517
	Thinning	437.00	262
	Wildlife habitat improvement	886.00	580
2,4-D/	Hardwood release	26.00	17
2,4-DP		25.00	
	Wildlife habitat improvement	45.00	30
		45.00	

See footnotes at end of table.

Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used	Units treated 1/
		Pounds 2/	
Herbicides: (Cont.)			
2,4-D/ Dicamba	Noxious weed control	4,055.54	3,703
		1,291.95	
	Range management	9.50	56
		5.00	
2,4-D/ Dicamba/ 2,4-DP	Rights-of-way	4.00	1 side miles
		2.00	
	Noxious weed control	20.00	100
		5.00	
2,4-D/ Dicamba/ Triclopyr	Rights-of-way	20.00	1
		2.00	
		2.00	
		2.00	
2,4-D/ Dicamba/ Triclopyr	Rights-of-way	19.32	5
		5.80	
		19.32	
		19.32	
2,4-D/ Dichlobenil	Noxious weed control	16.00	21
		16.00	
2,4-D/ Glyphosate	Noxious weed control	129.00	86
		43.00	
	Rights-of-way	67.50	15
		65.25	
2,4-D/ MCPA	General weed control	0.39	5
		0.42	
2,4-D/ Picloram	Conifer release	419.00	1,715
		125.00	
	Hardwood release	240.25	358
		11.00	
	Noxious weed control	5,187.64	7,587
		1,544.35	
	Rights-of-way	203.00	283
		115.25	
	Site preparation	581.49	1,519
		263.62	
	Wildlife habitat improvement	360.00	1,339
		93.00	
	Wildlife habitat improvement	30.00	1,900 trees
		8.00	
2,4-D/ Picloram/ Triclopyr	Rights-of-way	256.00	175
		68.00	
		342.00	
2,4-D/ Triclopyr	Range management	2.00	29
		1.00	

See footnotes at end of table.

Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used	Units treated 1/
		Pounds 2/	
Herbicides: (Cont.)			
2,4-DP	Noxious weed control	7.80	39
	Rights-of-way	100.00	25
	Rights-of-way	2,222.50	90 side miles
	Thinning	55.00	65
Total 1988 herbicide use		165,086.08	116,346

See footnotes at end of table.



Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used Pounds 2/	Units treated 1/
Insecticides:			
Azinphos-methyl	Cone and seed insects	1,182.72	715 (A)
<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>	Gypsy moth	349,408.00 BIU	20,238 (A)
	Western spruce budworm	6,548,080.64 BIU	409,248 (A)
	Tussock moth	78,016.00 BIU	5,177 (A)
Carbaryl	Grasshoppers	497.00	3,210 (A)
	Mormon cricket	750.00	1,500 (A)
Fenvalerate	Cone and seed insects	17.00	140 (A)
Malathion	Grasshoppers	2,160.00	4,320 (A)
Nucleopolyhedrosis virus	Gypsy moth	9.81	400 (A)
Acephate	Aphids	9.99	5,213 seedlings
	Cone and seed insects	0.84	15 trees
	Sawflies	3.00	4
	Spruce budworm	3.67	110 trees
	Tussock moth	0.37	100 trees
	Western spruce budworm	36.23	1,373 trees
Azinphos-methyl	Seedbugs	70.00	22
<i>Bacillus thuringiensis</i> var. <i>israelensis</i>	Mosquitoes	74.00 BIU	260
<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>	Bagworms	1,008.00 BIU	84
	Western spruce budworm	10,680.00 BIU	380
Bendiocarb	Termites	0.01	4 buildings
Carbaryl	Aphids	13.00	3,500 seedlings
	Balsam woolly aphid	0.45	4,000 seedlings
	Bark beetles	5.00	2
	Cottonwood leaf beetle	4.00	4
	Fleas	20.00	70
	Fleas	30.00	150 bait stations
	Greenhouse insects	0.72	1,068 square feet
	Mountain pine beetle	2.25	25
	Mountain pine beetle	1,875.50	3,842 trees
	Pine tip moth	4.00	4
	Spruce budworm	50.00	115 trees
	Western pine beetle	2.50	5
	Western pine beetle	785.00	1,750 trees
Carbaryl/	Elm leaf beetle	2.00	8 trees
Malathion		2.00	
Carbofuran	Cone and seed insects	50.00	46,000 square feet
	Cone and seed insects	50.00	10 trees
Chlorpyrifos	Ants	2.12	42 buildings
	Carpenter ant	3.20	2 buildings
	Pales weevil	90.25	231
	Termites	50.00	2 buildings

See footnotes at end of table.

Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used Pounds 2/	Units treated 1/
Insecticides: (Cont.)			
Chlorpyrifos	Webworms	16.00	16
	Wood borer	1.00	10
Coumaphos	Miscellaneous insects	12.00	2,000 head of cattle
	Ticks	225.00	12,000 head of cattle
Diazinon	Ants	2.50	1
	Aphids	1.27	3
	Cutworms	22.00	5
	Miscellaneous insects	0.50	4
	Nursery insects	117.50	130
	Sucking insects	5.43	2
Diflubenzuron	Gypsy moth	67,429.00	38,332
Dimethoate	Cone midges	22.33	269 trees
	Pine tip moth	3.00	3
	Tip moths	9.00	22
Disparlure 3/	Gypsy moth	30.86	49
Esfenvalerate	Cone and seed insects	21.10	111
Fenbutatin-oxide	Mites	2.50	20,000 seedlings
Fenvalerate	Cone borers	76.00	50
	Nursery insects	9.99	100
	Seedbugs	180.00	266
	Seedworms	5.67	266 trees
Lindane	Bark beetles	469.00	8,114 trees
	Southern pine beetle	64.00	20
	Southern pine beetle	12.00	275 trees
Malathion	Aphids	2.00	5
	Scales	9.00	300 trees
Methomyl	Miscellaneous insects	4.00	18
Permethrin	Fleas	10.00	22
	Seedbugs	3.20	1,000 trees
Pheromones	Mountain pine beetle	5.27	205
	Mountain pine beetle	15.41	1,480 treatment stns
	Sawflies	35.00	400 bait stations
	Shoot moths	0.82	75
Pyrethrins	Termites	4.00	4 buildings
Total 1988 insecticide use (including aerial use)		76,608.98	485,488
Total aerial use		4,616.53	444,948

See footnotes at end of table.

Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used Pounds 2/	Units treated 1/
Fungicides and Fumigants:			
Benomyl	Botrytis	67.47	185
	Damping-off	2.87	9
	Damping-off	5.00	195,000 seedlings
	Fusarium	2.94	6
	Fusarium	0.50	9,400 seedlings
	Nursery fungi	157.00	7
	Nursery fungi	5,250.00	9,786,000 seedlings
	Nursery root rot	39.50	12
	Seedling blights	3.70	19
	Phomopsis canker	20.00	41
	<i>Fomes annosus</i>	1,386.00	11,231
Borax	<i>Fomes annosus</i>	993.00	3,457 stumps
Bordeaux mixture	Diplodia tip blight	1.00	1
	Other diseases	400.00	156 tree groups
Captan	Botrytis	1.00	175,000 seedlings
	Damping-off	58.00	71
	Damping-off	1.00	1 greenhouse
	Greenhouse diseases	7.50	15 greenhouses
	Nursery fungi	2.50	76,000 seedlings
Chloropicrin	Seedling root diseases or decays	19.91	55
Chlorothalonil	Botrytis	80.40	164
	Botrytis	28.50	175,000 seedlings
	Fusarium	364.47	109
	Lophodermium needle blight	165.00	73
	Nursery blight	11.23	4
	Other diseases	15.00	5
	Phoma blight	110.10	69
	Wood product stains molds or decays	7.00	200 square feet
Copper compounds	Damping-off	500.00	2
	Nematodes	3,155.00	11
	Nursery fungi	14,163.03	128
DCNA	Botrytis	2.14	2
	Botrytis	1.00	15 greenhouses
Dichloropropane	Nursery root rot	5,791.50	16
Dodine	Shot hole disease	3.00	3
Ethazol	Damping-off	34.00	1
	Damping-off	2.39	15 greenhouses
	Nursery root rot	0.46	11,000 seedlings
	Damping-off	17.00	1
Ethazol/ Thiophanate-methyl		29.00	
Maneb	Lophodermium needle blight	74.00	32
Metam-sodium	Nursery fungi	12.00	1
Metalaxyl	Damping-off	0.04	330,000 seedlings
	Nursery root rot	12.38	14
Methyl bromide	Fusarium	369.91	71

See footnotes at end of table.



Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used	Units treated 1/
		Pounds 2/	
Fungicides and Fumigants: (Cont.)			
Methyl bromide	Nursery fungi	15.00	2 greenhouses
	Nursery fungi	19.91	55
	Nematodes	12.00	2,400 square feet
Methyl bromide/ Chloropicrin	Damping-off	9,627.39	41
		4,781.10	
	Fusarium	6,418.80	40
		6,418.80	
	Nematodes	2,299.00	13
		2,299.00	
	Nursery fungi	720.00	4
		360.00	
	Nursery root rot	24,414.00	91
		12,025.00	
	Other diseases	8.00	1,581 square feet
		8.00	
Triadimefon	Fusiform rust	14.00	29
	Sirococcus tip blight	0.20	1
	White pine blister rust	1.27	12
Total 1988 fungicide and fumigant use		102,808.91	12,628

See footnotes at end of table.

Table 44--Pesticide use report--fiscal year 1988--Continued

Common name	Target pest or purpose	Quantity used Pounds 2/	Units treated 1/
Predacides and Piscicides:			
Antimycin	Undesirable fish	1.81	19 stream miles
Rotenone	Undesirable fish	5.32	5 acre feet
	Undesirable fish	11.00	15 stream miles
	Undesirable fish	5.00	2 treatment stns
Sodium cyanide	Coyote	1.00	54 bait stations
Total 1988 predacide and piscicide use		24.13	0
Repellents:			
Putrescent egg solids	Deer	3,963.26	18,942
Thiram	Birds	31.30	7,231 pounds of seed
	Rabbits	216.00	108
Total 1988 repellent use		4,210.56	19,050
Rodenticides:			
Aluminum phosphide	Prairie dog	25.00	169
	Prairie dog	1.00	200 burrows
Diphacinone	Ground squirrel	100.00	70
	Pocket gopher	16.66	2,417
Strychnine	Ground squirrel	5.00	3
	Pocket gopher	3,376.80	47,424
	Pocket gopher	0.12	95 burrows
Thiram	Mice	320.00	1,970 pounds of seed
	Other rodents	4.00	65 pounds of seed
Warfarin	Mice	1.00	10 buildings
Zinc phosphide	Pack rat	0.06	4 burrows
	Prairie dog	71.00	6,013
Total 1988 rodenticide use		3,920.64	56,096
Grand total pesticide use		352,659.30	689,608

1/ Acres, unless other units are indicated. Aerial applications are indicated by (A). All others are ground application.

2/ Pounds, unless other units are indicated. BIU = billion international units.

3/ Registered trademark name; no common name.

**Table 45—Wildfires on State and private lands protected under the Cooperative Forestry Assistance Act (P.L. 95-313)--calendar year 1987**

State, Commonwealth, or Territory	Acres protected <i>1,000 acres</i>	Lightening fires <i>Numbers</i>	Person-caused fires <i>Numbers</i>	Total fires <i>Numbers</i>	Acres burned
Alabama	25,726	45	11,181	11,226	206,535
Alaska	66,301	42	452	494	60,347
Arizona	18,328	76	253	329	25,853
Arkansas	19,728	79	4,071	4,150	67,078
California	31,181	733	7,329	8,062	86,945
Colorado	25,958	73	1,121	1,194	24,208
Connecticut	2,390	2	903	905	2,141
Delaware	557	2	32	34	1,454
Florida	27,102	805	4,364	5,169	75,265
Georgia	27,279	365	12,204	12,569	51,974
Guam	82	0	1,541	1,541	10,473
Hawaii	3,306	1	112	113	27,544
Idaho	6,026	132	294	426	4,811
Illinois	8,453	0	121	121	7,198
Indiana	7,328	1	306	307	4,657
Iowa	7,612	6	2,550	2,556	4,260
Kansas	18,470	107	2,737	2,844	38,290
Kentucky	16,936	9	3,274	3,283	285,036
Louisiana	122,855	20	7,083	7,103	90,060
Maine	20,192	68	756	824	3,693
Maryland	3,552	21	836	857	7,296
Massachusetts	3,581	6	4,342	4,348	6,116
Michigan	20,600	37	809	846	9,523
Minnesota	22,800	42	2,802	2,844	88,144
Mississippi	19,858	17	10,043	10,060	170,281
Missouri	16,587	19	3,329	3,348	29,732
Montana	48,633	59	488	547	4,639
Nebraska	49,083	126	1,350	1,476	29,850
Nevada	81,687	82	130	212	17,688
New Hampshire	4,631	6	495	501	159
New Jersey	2,895	5	977	982	2,268
New Mexico	42,500	82	542	624	63,710
New York	16,957	2	268	270	1,072
North Carolina	19,540	89	3,755	3,844	17,814
North Dakota	31,879	16	412	428	6,919
Ohio	5,823	2	1,620	1,622	9,793
Oklahoma	5,080	17	1,769	1,786	33,319
Oregon	13,099	481	953	1,434	73,292
Pennsylvania	19,541	5	1,325	1,330	5,309
Rhode Island	433	1	115	116	184
South Carolina	12,558	150	5,313	5,463	21,190
South Dakota	20,653	183	1,455	1,638	52,277
Tennessee	12,672	31	5,447	5,478	112,459
Texas	20,659	13	2,242	2,255	28,730
Utah	15,000	175	315	490	28,299
Vermont	4,638	3	196	199	424
Virginia	18,325	42	1,284	1,326	20,393
Washington	13,177	173	1,409	1,582	9,515
West Virginia	12,833	12	2,261	2,273	429,174
Wisconsin	18,898	73	2,003	2,076	4,867
Wyoming	25,540	136	680	816	21,123
<b>Total</b>	<b>1,059,522</b>	<b>4,672</b>	<b>119,649</b>	<b>124,321</b>	<b>2,383,381</b>



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Table 46--Summary of selected cooperative forest management and processing program activities--selected fiscal years

	Woodland owners assisted	Timber sale assistance-- volume marked <i>MBF 1/</i>	Loggers and processors assisted
1945	8,093	411,330	0
1950	22,828	518,566	0
1955	34,828	549,373	8,182
1960	82,188	569,178	8,099
1965	99,074	716,950	9,248
1970	115,197	1,225,520	13,620
1971	127,828	860,950	14,627
1972	274,001	955,627	5,290
1973	106,422	1,578,664	4,855
1974	117,990	907,311	5,353
1975	140,940	677,532	5,405
1976	105,184	596,599	15,318
1976 -77 (T.Q.) 2/	25,253	220,649	5,849
1977	133,619	921,171	29,101
1978	165,329	1,120,743	12,749
1979	183,585	755,103	11,393
1980	176,385	870,964	11,582
1981	164,279	683,181	18,609
1982	141,472	841,475	15,470
1983	136,265	872,125	8,717
1984	151,539	1,033,440	10,082 3/
1985	134,338	913,411	- 4/
1986	137,753	855,813	- 4/
1987	158,353	1,225,896	- 4/
1988	167,432	890,581	- 4/

1/ MBF = thousand board feet.

2/ Transition quarter.

3/ Not all states reported.

4/ Inadequate data due to lack of State grants in wood utilization program.

**Table 47--Summary of selected cooperative forest management and processing activities by Region--fiscal year 1988**

Assistance activity	Unit of measure 1/	Regions				
		Northern	Rocky Mountain	South-western	Inter-mountain	Pacific Southwest
Woodland owners assisted	Number	4,071	3,082	193	27	4,379
Forest management plans prepared	Number	419	401	56	23	199
	Acres	36,606	21,203	17,326	2,425	55,359
Reforestation:						
Planting	Acres	935	1,398	238	250	4,845
Seeding	Acres	0	37	0	0	2,514
Management for natural regeneration	Acres	112	4,611	4,038	200	1,584
Timber stand improvement	Acres	633	2,475	286	2,013	3,195
Outdoor recreation development	Acres	1,490	2,960	10,323	1,582	41,231
Wildlife habitat development	Acres	718	4,981	10,823	3,142	52,886
Forested range improvement	Acres	160	2,779	9,623	3,902	13,721
Timber sale assistance volume harvested	M cubic feet	4,216	3,868	1,601	792	32
Urban forestry assistance activities	Urban areas assisted	108	678	14	20	635
Referrals to consulting foresters	Number	83	191	35	174	698

See footnote at end of table.



**Table 47—Summary of selected cooperative forest management and processing activities by Region--fiscal year 1988--Continued**

Assistance activity	Unit of measure 1/	Regions			North-eastern Area	Total
		Pacific Northwest	Alaska	Southern Region		
Woodland owners assisted	Number	7,217	142	82,958	65,363	167,432
Forest management plans prepared	Number	857	142	53,861	17,525	73,483
	Acres	47,200	2,880	2,653,823	1,130,650	3,967,472
Reforestation:						
Planting	Acres	23,672	42	1,168,454	67,911	1,267,745
Seeding	Acres	0	0	10,548	1,669	14,768
Management for natural regeneration	Acres	14,417	100	62,924	38,921	126,907
Timber stand improvement	Acres	27,837	94	171,419	51,837	259,789
Outdoor recreation development	Acres	0	0	112,243	60,377	230,206
Wildlife habitat development	Acres	3,769	355	371,574	149,606	597,854
Forested range improvement	Acres	1,958	0	17,036	9,675	58,854
Timber sale assistance volume harvested	M cubic feet	19,979	1,000	112,532	90,872	234,892
Urban forestry assistance activities	Urban areas assisted	33	3	917	2,582	4,990
Referrals to consulting foresters	Number	186	20	5,913	9,832	17,132

1/ M = thousand.

Table 48—Summary of selected cooperative forest management and processing activities by State--fiscal year 1988

State, Commonwealth, or Territory	Woodland owners assisted	Reforestation assistance	Timber stand improvement assistance	Timber sale assistance-- harvest volume	State nursery production
		<i>Acres</i>	<i>Acres</i>	<i>1,000 cubic feet</i>	<i>1,000 trees</i>
Alabama	14,635	204,000	41,063	0	76,654
Alaska	142	142	94	1,000	200
Arizona	68	4,226	236	1,001	112
Arkansas	2,407	41,018	1,612	967	29,652
California	3,912	8,488	2,752	2	2,622
Colorado	1,138	2,650	420	2,836	1,523
Com. of N. Marianas	40	13	26	0	9
Connecticut	802	804	92	0	1,023
Delaware	958	2,395	50	461	0
Florida	3,676	106,988	18,265	207	66,268
Fed. Sta. Micronesia	56	75	378	0	26
Georgia	18,009	249,421	13,031	1,771	195,400
Guam	7	53	35	0	63
Hawaii	339	312	0	30	462
Idaho	2,684	628	373	2,240	641,000
Illinois	13,988	5,485	3,200	1,568	3,650
Indiana	2,655	7,743	9,808	2,125	5,556
Iowa	1,295	5,862	1,574	554	3,777
Kansas	624	780	893	339	130
Kentucky	1,277	7,994	1,798	4,901	9,139
Louisiana	1,571	29,480	27,843	1,252	44,320
Maine	1,574	1,477	4,872	136	1,421
Maryland	3,032	6,999	4,338	3,846	4,300
Massachusetts	1,382	14,094	3,702	10,628	0
Michigan	928	3,110	869	3,132	3,149
Minnesota	6,332	21,285	3,028	8,875	18,100
Mississippi	14,437	238,247	28,246	3,006	74,337
Missouri	2,158	2,320	2,827	16,435	5,799
Montana	640	142	256	1,919	1,332
Nebraska	813	67	25	36	0
Nevada	17	450	1,995	392	175
New Hampshire	3,068	540	603	451	390
New Jersey	1,413	715	457	573	747
New Mexico	125	50	50	600	15
New York	3,006	4,547	4,103	11,091	5,929
North Carolina	6,695	108,669	4,638	29,181	51,885
North Dakota	747	277	4	57	1,062
Ohio	3,373	2,107	3,460	4,002	7,243
Oklahoma	774	2,480	1,052	594	4,069
Oregon	6,138	29,195	22,894	2,605	14,600
Palau	25	2	4	0	25
Pennsylvania	2,605	1,887	1,940	2,456	3,378
Puerto Rico	1,964	622	758	30	200
Rhode Island	268	47	111	57	0
South Carolina	4,188	155,800	7,862	1,998	78,788
South Dakota	340	2,544	312	380	1,572
Tennessee	2,530	14,042	97	2,228	11,038
Texas	2,127	22,546	413	11,054	23,806

**Table 48--Summary of selected cooperative forest management and processing activities  
by State--fiscal year 1988--Continued**

State, Commonwealth, or Territory	Woodland owners assisted	Reforestation assistance	Timber stand improvement assistance	Timber sale assistance-- harvest volume	State nursery production
		<i>Acres</i>	<i>Acres</i>	<i>1,000 cubic feet</i>	<i>1,000 trees</i>
Utah	10	0	18	400	0
Vermont	3,586	491	2,240	3,549	500
Virginia	8,668	60,619	24,741	55,343	75,271
Washington	1,079	8,894	4,943	17,374	12,050
West Virginia	3,030	2,263	1,334	0	0
Wisconsin	9,910	24,330	3,229	20,933	22,446
Wyoming	167	5	825	277	0
Total	167,432	1,409,420	259,789	234,892	1,505,213



**Table 49—Small watershed protection accomplishments--fiscal years 1984-88**  
(P.L. 83-566, Act of 1954) 1/

	Unit of measure	1988	1987	1986	1985	1984
Land treatment 2/	Acres					
Forest land		9,692	5,462	9,785	7,492	14,224
Cropland		2,079	1,061	2,802	1,488	1,997
Pastureland		831	424	1,121	598	799
Total land treatment		12,602	6,947	13,708	9,578	17,020
Land owners assisted	Number	1,068	372	581	675	748

1/ This table has been significantly changed from that shown in the FY 1987 Report of the Forest Service. Data are no longer collected in the previous format and accomplishments are now limited to activities accomplished solely by small watershed protection program funds.

2/ Reported in land use categories consistent with those reported by the Soil Conservation Service.

**Table 50—Flood prevention accomplishments--fiscal years 1984-88**  
(P.L. 78-534, Act of 1944) 1/

	Unit of measure	1988	1987	1986	1985	1984
Land treatment 2/	Acres					
Forest land		6,742	6,399	18,702	17,890	23,919
Cropland		454	793	925	1,160	1,132
Pastureland		182	317	370	464	453
Total land treatment		7,378	7,509	19,997	19,514	25,504
Land owners assisted	Number	2,932	5,113	3,416	3,100	7,047

1/ This table has been significantly changed from that shown in the FY 1987 Report of the Forest Service. Data are no longer collected in the previous format and accomplishments are now limited to activities accomplished solely by flood prevention project program funds.

2/ Reported in land use categories consistent with those reported by the Soil Conservation Service.

Table 51—Forest Research funding--fiscal year 1988 compared to 1984-88 average 1/

	Actual	RPA		1984-88 average	Percent of actual to average
		Low bound	High bound		
1,000 constant 1988 dollars					
Appropriated funds:					
Land and resource protection research:					
Fire and atmospheric sciences	8,945	7,769	8,450	8,596	104
Forest insect and disease	22,545	20,773	22,371	23,080	98
Forest inventory and analysis	17,664	14,642	17,188	17,085	103
Renewable resources economics	4,977	4,587	4,931	4,889	102
Renewable resources management and utilization research:					
Timber management	26,548	21,968	23,945	24,566	108
Watershed management and rehabilitation	16,692	15,296	16,753	14,822	113
Wildlife, range, and fish habitat	12,567	9,565	11,478	10,891	115
Forest recreation	2,712	2,138	3,278	2,397	113
Forest products and harvesting	19,860	18,031	21,489	19,618	101
Special projects, competitive grants 2/	(3,000)	– 3/	–	–	–
Subtotal	132,510	114,769	129,883	125,943	105
Research construction	2,908	354	1,771	1,238	235
Total, appropriated accounts	135,418	115,123	131,654	127,181	106
Reimbursable accounts	4,101	– 3/	– 3/	5,312	77
Grand total	139,519	115,123	131,654	132,493	105

1/ General Administration has been eliminated from individual line items in calculating the average. Total appropriated General Administration funds are included in the "General Administration" line item in tables 10 and 11.

2/ Funds transferred to the Competitive Research Grants Office, Cooperative State Research Service, Department of Agriculture, included here as a non-add item.

3/ -- = not reported in the RPA.

Table 52—Forest Research funding--fiscal years 1984-88 1/

	1988	1987	1986	1985	1984
	<i>1,000 dollars</i>				
Appropriated funds:					
Land and resource protection research:					
Fire and atmospheric science	8,945	8,235	7,716	7,963	7,783
Forest insect and disease	22,545	22,989	20,186	21,147	22,129
Forest inventory and analysis	17,664	17,741	16,316	17,133	12,128
Renewable resources economics	4,977	4,477	4,370	4,513	4,748
Renewable resources management and utilization research:					
Timber management	26,548	23,891	21,501	22,161	22,137
Watershed management and rehabilitation	16,692	16,397	14,850	11,229	11,242
Wildlife, range, and fish habitat	12,567	11,757	9,072	9,108	9,163
Forest recreation	2,712	2,426	2,049	2,084	2,085
Forest products and harvesting	19,860	18,808	17,560	18,488	17,988
Special projects, competitive grants 2/	(3,000)	(6,000)	(6,507)	(7,840)	0
Subtotal	132,510	126,721	113,620	113,826	109,403
Research construction	2,908	343	642	1,634	422
Total, appropriated accounts	135,418	127,064	114,262	115,460	109,825
Reimbursable accounts	4,101	4,801	5,746	5,159	5,192
Grand total	139,519	131,865	120,008	120,619	115,017

1/ General Administration has been eliminated from individual line items. Total appropriated General Administration is included in tables 10 and 11.

2/ New account in 1985. Funds are transferred to the Competitive Research Grants Office, Cooperative State Research Service, Department of Agriculture, which administers the competitive grants research program.



Table 53—Extramural research funded through the Forest Service--fiscal years 1987-88

Type of recipient	1988		1987	
	<i>1,000 dollars</i>	<i>Number of grants</i>	<i>1,000 dollars</i>	<i>Number of grants</i>
Domestic grantees:				
Universities and colleges:				
Land Grant research institutions	10,384	329	10,495	341
1890 Land Grant and predominately black institutions	531	16	303	24
Other non-Land Grant institutions	1,957	59	1,808	68
Subtotal, universities and colleges	12,872	404	12,606	433
Other domestic:				
Industrial firms	40	2	253	3
Profit organizations	—	—	—	—
Nonprofit institutions and organizations	505	8	638	15
Federal, State, and local governments	444	17	279	15
Private individuals	48	8	245	16
Small business innovation research	528	15	571	28
Subtotal, other domestic	1,565	50	1,986	77
Total, domestic	14,437	454	14,592	510
Foreign grantees:				
Universities and colleges	16	2	17	4
Government agencies			—	—
Nonprofit institutions and organizations	8	1	—	—
Private individuals	13	4	—	—
Total, foreign grantees	37	7	17	4
Grand total	14,474	461	14,609	514

Table 54--Research publications by major subject area--fiscal years 1985-88

	Number of publications			
	1988	1987	1986	1985
Environmental Research:				
Watershed management	156	134	138	154
Wildlife	156	162	165	136
Range	82	92	94	64
Fisheries habitat	38	27	26	18
Forest recreation	44	62	65	69
Urban and community forestry	31	42	45	36
Disturbed areas rehabilitation	33	19	26	34
Atmospheric deposition and air pollution	59	36	39	35
Subtotal	599	574	598	546
Insect and Disease Research:				
Insect detection and evaluation	52	54	57	69
Insect biology	44	96	98	94
Insect control and management strategies	63	90	92	119
Disease detection and evaluation	19	67	65	51
Disease biology	54	46	48	45
Disease control and management strategies	51	24	29	37
Mycorrhizae	42	17	21	50
Wood products organisms	14	17	18	24
Subtotal	339	411	428	489
Fire and Atmospheric Sciences Research:				
Fire prevention, hazard reduction, and prescribed burning	35	20	20	19
Fire management methods and systems	27	20	21	25
Forest fire science	14	28	28	23
Ecological relations	37	18	19	35
Weather modification and weather effects	10	17	19	35
Subtotal	123	103	107	137
Timber Management Research:				
Forest biology	173	160	158	109
Silviculture and management	153	153	162	196
Growth and yield	127	66	69	68
Genetics and tree improvement	72	78	87	100
Subtotal	525	457	476	473

Table 54—Research publications by major subject area--fiscal years 1985-88--Continued

	Number of publications			
	1988	1987	1986	1985
Economics and Marketing Research:				
Forest resource evaluation	203	138	143	110
Forest economics	131	196	205	182
Subtotal	334	334	348	292
Products and Engineering Research:				
Forest engineering systems	57	70	71	84
Wood structural engineering	71	51	53	52
Chemistry, fiber, and fuel products	25	60	62	59
Utilization potential and processing of wood	77	128	135	133
Protection of wood in use	55	29	31	13
Subtotal	285	338	352	341
General	22	20	21	21
Grand total	2,227	2,237	2,330	2,299



Table 55--Summary statement of receipts and expenditures--fiscal years 1987-88

	1988		1987		Percent of Change 1987 to 1988	
	Receipts	Expenditures	Receipts	Expenditures	Receipts	Expenditures
National Forest programs:						
Receipts:						
Cash receipts and appropriation expenditures:						
Sale of timber and use of other forest resources	950,189	0	886,848	0	7	0
Use of National Grasslands and land utilization areas	29,972	0	38,498	0	-22	0
Timber sale area betterment (K-V) 1/	238,002	0	202,596	0	17	0
Cooperative work for others	58,332	0	55,355	0	5	0
Brush disposal	58,606	0	63,050	0	-7	0
Miscellaneous (sales, rentals, damages, etc.) 2/	10,217	0	12,714	0	-20	0
Restoration of forest lands and improvements	80	0	188	0	-58	0
Recreation permit sales & fees from designated areas	23	0	5	0	347	0
Timber salvage sales	29,174	0	18,681	0	56	0
Operation & maintenance of quarters	5,610	0	5,902	0	-5	0
Gifts, donations, and bequests	1,577	0	46	0	3,302	0
Subtotal	1,381,782	0	1,283,885	0	8	0
Cash receipts from NFS lands collected in conjunction with, and deposited to, accounts of other agencies						
Non-cash income (roads built by timber purchasers)	138,529	0	106,619	0	30	0
	98,002	0	107,391	0	-9	0
Total	1,618,313	0	1,497,895	0	8	0
Expenditures:						
Operating costs	0	2,005,863	0	1,829,644	0	10
Capital outlay	0	248,728	0	197,375	0	26
Total	0	2,254,591	0	2,027,018	0	11
Other Forest Service programs:						
Forest Research programs:						
Forest research	0	146,462	0	140,071	0	5
Research construction	0	708	0	2,090	0	-66
Cooperative research work 3/	0	3,076	3,688	2,730	-100	13
Gifts, donations, and bequests for forest rangeland research	3	1,320	28	121	-89	995
Tongass Timber Supply Fund	0	1,653	0	2,359	0	-30
Energy security reserve	0	1	0	0	0	0
Subtotal	3	153,220	3,716	147,369	-100	4

See footnotes at end of table.

Table 55--Summary statement of receipts and expenditures--fiscal years 1987-88--Continued

	1988		1987		Percent of Change 1987 to 1988	
	Receipts	Expenditures	Receipts	Expenditures	Receipts	Expenditures
	1,000 constant 1988 dollars					
State and Private Forestry programs:						
State and Private Forestry cooperation	0	91,817	0	67,023	0	37
Rural community fire protection	0	3,071	0	3,161	0	-3
Flood prevention and watershed protection	0	1,536	0	1,248	0	23
Licensee programs (Woody Owl and Smokey Bear)	106	308	90	30	18	931
Forestry Incentives and other programs 4/	0	1,942	0	1,880	0	3
Subtotal	106	98,674	90	73,342	18	35
Human Resource programs:						
Job Corps	0	60,718	0	59,452	0	2
Senior Community Service Employment	0	22,641	0	21,012	0	8
Subtotal	0	83,359	0	80,464	0	4
Grand total, all programs	1,618,422	2,589,844	1,501,701	2,328,193	8	11
Cash receipts distributed to States, counties and Puerto Rico:						
Payments to States and Puerto Rico	0	293,294	0	269,931	0	9
Payment to Minnesota	0	716	0	737	0	-3
Payments to counties, (National Grasslands and Land Utilization Areas)	0	11,014	0	7,588	0	45
Subtotal	0	305,024	0	278,257	0	10
Internal equipment and supply service (Working Capital)	88,923	102,809	90,072	92,920	-1	11
Reimbursements for work performed for government and others included above	0	76,381	0	70,968	0	8

1/ K-V = Knutson-Vandenberg.

2/ Includes sale of personal property and acquisitions of lands to complete land exchanges.

3/ Receipts not available as a separate item after FY 1987.

4/ Includes Resource Conservation and Development, River Basins, and Pesticide Impact assessment funds transferred from Agricultural Research Service.

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Table 56—Summary statement of values and expenditures--fiscal year 1988

Item	Units 1/	Quantity	Average value per unit	Total value
				<i>Million dollars</i>
Value:				
Minerals				
Common variety	-- 2/	--		44.5
Locatable	--	--		716.1
Leasable				
Oil	M BBL	22,800	13.50	107.8
Gas	MMCF	191,000	1.87	357.2
Coal	M tons	41,200	45.95	1,893.1
Others		--	--	161.7
Timber (excluding free firewood)	MBF	11,348	110.54 3/	1,254.4
Recreation	M RVD	242,316	8.96 4/	2,171.2
Wilderness and primitive areas	M RVD	11,800	10.74	126.7
Wildlife and fish				
Recreation	M WFUD	41,200	24.36	1,004.0
Commercial	M pounds	106,000	997.04	105.7
Range 5/	M AUM	9,872	6.30	62.2
Total value				8,004.6
Expenditures:				
National Forest System				2,254.6
Forest Research				153.2
State and Private Forestry				98.7
Human Resource Programs				83.4
Total expenditures				2,589.9
Net value, total				5,414.7
Net value, National Forest System only				5750.0

1/ M BBL = thousand barrels; MMCF = million cubic feet; M tons = thousand tons; MBF = thousand board feet; M RVD = thousand recreation visitor days; M pounds = thousand pounds; M AUM = thousand animal unit month; M WFUD = thousand wildlife fish user days AF = acre feet.

2/ -- = not available.

3/ Actual value at time of sale.

4/ Exclusive of wilderness, wildlife, and fish.

5/ Based on permitted to graze animal unit months of forage. Value is a Forest Service-wide weighted average based on maximum ability to pay. Ability to pay reflects income derived by the user from use of the resource.

Table 57-Statement of receipts--fiscal years 1984-88

	1988	1987	1986	1985	1984
			1,000 dollars		
Receipts from sale and use of forest resources:					
Timber and forest products	888,373	807,941	745,132	514,561	544,265
Grazing	8,738	8,104	8,617	9,040	9,618
Land uses	4,472	4,394	4,073	3,348	3,442
Recreation	34,307	30,579	30,275	30,829	27,541
Power	824	688	765	647	834
Minerals	43,447	46,688	42,913	77,522 1/	51,649
Subtotal	980,161	898,394	831,775	635,947	637,349
Receipts from deposits for expenditures on National Forests:					
Timber sale area betterment	238,002	196,695	156,092	186,107	165,463
Timber salvage sales	29,174	18,137	20,677	15,232	20,514
Brush disposal	58,606	61,214	52,936	53,734	60,290
Restoration of Forest Service lands and improvements	80	183	176	172	160
Cooperative work	58,332	53,743	43,423	38,613	43,976
Operation and maintenance of quarters	5,610	5,730	5,352	4,854	
Gifts, donations, and bequests	1,577	45	25	36	
Subtotal	391,381	335,747	278,681	298,748	290,403
Other receipts:					
Miscellaneous (sales, rents, etc.)	9,889	11,947	10,644	5,236	14,844
Golden Eagle passports	23	5	3	2	4
Sale of personal property	3	12	17	10	35
Cooperative research 2/	0	3,581	3,001	1,265	1,187
Royalties from sale of Smokey Bear and Woodsy Owl products	106	87	96	74	186
Acquisition of lands to complete land exchanges	325	385	1,573	1,086	380
Gifts, donations, and bequests for forest rangeland research	3	27	0	0	0
Subtotal	10,349	16,044	15,334	7,673	16,636

See footnotes at end of table.

Table 57—Statement of receipts--fiscal years 1984-88--Continued

	1988	1987	1986 <i>1,000 dollars</i>	1985	1984
Other income:					
Estimated collections by Department of Energy for power licenses on proclaimed National Forest land	1,175	601	439	543	618
Estimated collections by Department of the Interior for mineral leases on proclaimed National Forest land	137,354	102,913	77,286	81,878	84,850
Value of roads built by timber purchasers applied in lieu of cash payment for timber	98,002	104,263	117,026	107,949	154,108
Subtotal	236,531	207,777	194,751	190,370	239,576
Total	1,618,422	1,457,962	1,320,541	1,132,738	1,183,964
Other net deposits:					
Monies advanced on active timber sales 3/					
Balance from previous year	247,250	219,872	192,180	213,853	264,534
Deposited current year	1,350,365	1,169,636	1,014,971	842,201	869,404
Transferred to other accounts	-1,344,378	1,142,258	-987,279	-863,874	-920,085
Balance on deposit	253,237	247,250	219,872	192,180	213,853
Amounts deposited pending disposition 4/					
Balance from previous year	16,492	9,396	18,553	328	15,292
Deposited current year	14,790	11,943	20,072	34,012	9,709
Transferred to other accounts	-3,672	-4,847	-29,229	-15,787	-24,673
Balance on deposit	27,610	16,492	9,396	18,553	328
Subtotal	280,847	263,742	229,268	210,733	214,181
Total	1,899,269	1,721,704	1,549,809	1,343,471	1,398,145

1/ Includes \$19 million adjusted windfall profit tax payment for 1980-84.

2/ Not available as a separate item after 1987. Included in Cooperative Work, above.

3/ Timber sale deposits made by timber purchasers.

4/ Budget clearing account.



Table 58--Statement of receipts--fiscal year 1988

	National Forests	Oregon and California grant lands	National Grasslands & L.U. Areas 1/	Other	Total
	<i>1,000 dollars</i>				
Receipts from sale and use of forest resources:					
Timber and forest products	862,589	25,783	1		888,373
Grazing	8,013	1	724		8,738
Land uses	4,145	1	326		4,472
Recreation	34,243	52	12		34,307
Power	816		8		824
Minerals	14,545	1	28,901		43,447
Subtotal	924,351	25,838	29,972	0	980,161
Receipts from deposits for expenditures on National Forests:					
Timber sale area betterment	238,002				238,002
Timber salvage sales	29,174				29,174
Brush disposal	58,606				58,606
Restoration of Forest Service lands and improvements	80				80
Cooperative work	58,332				58,332
Operation and maintenance of quarters	5,610				5,610
Gifts, donations, and bequests	1,577				1,577
Subtotal	391,381				391,381
Other receipts:					
Miscellaneous (sales, rents, etc.)				9,889	9,889
Golden Eagle passports 2/				23	23
Sale of personal property 2/				3	3
Cooperative research 3/					
Royalties from sale of Smokey Bear and Woodsy Owl products				106	106
Acquisition of lands to complete land exchanges					
Gifts, donations, and bequests for forest rangeland research				325	325
Subtotal				10,349	10,349

See footnotes at end of table

Table 58--Statement of receipts--fiscal year 1988--Continued

	National Forests	Oregon and California grant lands	National Grasslands & L.U. Areas 1/	Other	Total
	1,000 dollars				
Other income:					
Estimated collections by Department of Energy for power licenses on proclaimed National Forest land	1,175				1,175
Estimated collections by Department of the Interior for mineral leases on proclaimed National Forest land	137,354				137,354
Value of roads built by timber purchasers in lieu of cash	98,002				98,002
Subtotal	236,531				236,531
Total	1,552,263	25,838	29,972	10,349	1,618,422
Other net deposits:					
Monies advanced on active timber sales					
Balance from previous year	247,250				247,250
Deposited current year	1,350,365				1,350,365
Transferred to other accounts	-1,344,378				-1,344,378
Balance on deposit	253,237				253,237
Amounts deposited pending disposition					
Balance from previous year	16,492				16,492
Deposited current year	14,790				14,790
Transferred to other accounts	-3,672				-3,672
Balance on deposit	27,610				27,610
Subtotal	280,847				280,847
Grand total	1,833,110	25,838	29,972	10,349	1,899,269

1/ Land Utilization Projects.

2/ These receipts are credited to the Department of the Interior.

3/ Not available as a separate item after FY 1987. Included in Cooperative Work, above.

Table 59--Statement of expenditures--fiscal year 1988

	Total	Work for other public agencies (reimbursables)
	<i>1,000 dollars</i>	
National Forest System:		
Protection and management	699,833	11,972
Fighting forest fires	440,303 1/	14,099
Cooperative work for others	45,199	0
Cooperative law enforcement	9,545	1
Flood prevention and watershed protection	1,878	1
Restoration of forest lands and improvements	100	0
Reforestation and timber stand improvement 2/	85,085	12
Timber sale betterment (K-V) 3/	158,873	0
Brush disposal	45,663	0
Timber salvage sales	50,710	0
Oregon and California grant lands	-7	0
Range betterment	3,287	0
Construction of facilities	27,556	613
Acquisition of lands, Forest Service	1,058	0
Acquisition of lands, Columbia Gorge	783	0
Acquisition of lands, Land and Water Conservation Fund	58,224	0
Construction of forest roads and trails	194,952	850
Timber purchaser roads constructed by the Forest Service	4,152	0
Restoration of roads, Federal Highway funds	551	0
Road construction, Mount St. Helens, highway trust	5,107	0
Road and trail maintenance	98,478	1,087
Mount St. Helens emergency activities	0	0
Tongass Timber Supply Fund	49,752	4
General Administration	264,686	2,170
Operation & maintenance of quarters	5,256	0
Auditors Building furniture acquisition	3,245	0
Hazardous waste management	322	0
Subtotal	2,254,591	30,809
Research:		
Tongass Timber Supply Fund	1,653	0
Forest research	146,462	14,059
Construction of research facilities	708	60
Cooperative research	3,076	0
Energy security reserve, DOE	1	0
Gifts, donations, and bequests for forest and rangeland research	1,320	0
Subtotal	153,220	14,119

See footnotes at end of table.



Table 59—Statement of expenditures--fiscal year 1988--Continued

	Total	Work for other public agencies (reimbursables)
	<i>1,000 dollars</i>	
State and Private Forestry:		
Cooperation and general forestry assistance	91,817	8,336
Resource conservation and development	786	0
Rural community fire protection grants	3,071	0
River basins	807	0
Flood prevention and watershed planning	1,536	0
Licensee programs (Smokey Bear and Woodsy Owl)	308	0
Forestry Incentives Program, Agricultural Conservation Program, and Pesticide Impact Assessment	349	0
Subtotal	98,674	8,336
Human Resource Programs:		
Job Corps	60,718	476
Senior Community Service Employment Program	22,641	22,641
Subtotal	83,359	23,117
Total	2,589,844	76,381
Internal equipment and supplies service:		
Working Capital Fund	102,809	102,809
Grand total	2,692,653	179,190

1/ \$412.63 million for suppressing fires in FY 1988, and \$27.67 million due to undisclosed obligations as of September 30, 1987.

2/ Includes obligations of \$30,698,992 for Reforestation Trust Fund.

3/ K-V = Knutson-Vandenberg Act.

Table 60—Statement of expenditures--fiscal years 1984-88

	1988	1987	1986	1985	1984
<i>Million dollars</i>					
National Forest System	2,254.6	1,967.9	1,718.7	1,849.5	1,737.4
Forest Research	153.2	143.1	127.9	123.0	117.0
State and Private Forestry	98.7	71.2	66.6	72.0	69.0
Human Resource Programs	83.4	78.1	78.2	73.8	76.4
Working Capital Fund	102.8	90.2	86.9	81.0	94.9
Total	2,692.7	2,350.5	2,078.3	2,199.3	2,094.7

**Table 61—Distribution of employees by program and occupational category--  
selected fiscal years 1/**

	1988	1987	1986	1980	1975
Research:					
Clerical	467	488	501	627	460
Technical	1,029	1,087	1,206	968	528
Administrative	349	302	246	302	246
Professional	1,298	1,284	1,240	1,452	1,408
Subtotal	3,143	3,161	3,193	3,349	2,642
State and Private Forestry:					
Clerical	92	58	46	163	81
Technical	136	47	46	80	31
Administrative	52	47	27	42	28
Professional	284	119	100	347	256
Subtotal	564	271	219	632	396
National Forest System:					
Clerical	4,006	4,121	4,351	6,361	6,411
Technical	24,928	22,657	23,726	30,036	28,774
Administrative	3,411	3,218	3,104	2,370	1,860
Professional	9,366	9,086	9,014	9,082	7,562
Subtotal	41,711	39,082	40,195	47,849	44,607
Total	45,418	42,514	43,607	51,830	47,645
Full-time equivalents 2/	38,830	36,744	36,918	49,005	30,123

1/ For 1988, employees in Regional Cooperative Forestry, Forest Pest Management, and Cooperative Fire positions are included in S&PF rather than in NFS, as is shown in 1986 and 1987.

2/ Full-time equivalent = 2,087 hours of paid employment.

**Table 62—Distribution of employees by tour of duty of selected fiscal years 1/**

	1988	1987	1986	1980	1975
Permanent full-time	28,781	27,400	27,419	21,421	19,568
Other permanent	2,118	2,901	3,017	15,815	12,115
Temporary	14,519	15,783	14,121	24,043	18,076
Total	45,418	46,084	44,557	61,279	49,759

1/ Beginning with FY 1988, data is reported as of the end of the fiscal year and not as of July, as was done in prior years.



Table 63--Summary of Forest Service Human Resource Programs--fiscal year 1988

	Program funding	Value of work accomplished	Persons served	Percent		Work accomplished 1/	Percent placement	Return per dollar invested
				Women	Minority			
		Million dollars						Dollars
Youth Conservation Corps 2/	Unfunded	3.6	1,567	44	14	294	-- 3/	1.22
Job Corps 4/	60.2	19.2	9,058	14	60	3,560	87	--
Senior Community Service Employment Program 4/	22.7	33.7	6,278	39	22	2,861	16	1.48
Volunteers in the National Forests 5/	Unfunded	25.5	65,060	31	11	1,918	--	--
Hosted programs	Unfunded	9.9	9,281	18	41	808	--	--
Total	82.9	91.9	91,244	--	--	9,441	--	--

1/ Person years.

2/ Funds were not directly appropriated for Youth Conservation Corps; the Congress earmarked not less than \$1 million to be expended from funds available to the Forest Service. We operated a \$3.0 million YCC program.

3/ -- = not applicable.

4/ Statistics are for the July 1, 1987, through June 30, 1988, program year.

5/ Statistics include the Touch America Project (TAP).

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